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Policy options and possible actions to expedite implementation: energy for sustainable development

Report of the Secretary-General

Summary

The present report highlights policy options and measures that could be taken at the international level with regard to improving access to energy, encouraging energy efficiency and promoting the use of advanced and cleaner energy technologies and other energy-related topics. Policy options and measures to encourage fuel switching from traditional biomass to modern energy services for cooking and heating are elaborated as a means for improving living standards, health and access to social services, including education, for women and children. A menu of policy options and possible actions to improve access to national electricity grids have been identified, including those aimed at lowering costs. Enhancing energy efficiency can reduce air pollution and regional and global atmospheric impacts as well as contribute to industrial development efforts. Policy options and possible actions to overcome market-related and institutional barriers to enhancing energy efficiency are identified along with ways to improve and transfer energy-efficient technologies. Strengthening the development and use of cleaner energy technologies also has a myriad of co-benefits including improving access to modern energy services, improving the way in which energy is produced and used, increasing industrial efficiency and reducing atmospheric emissions. Possible policies and measures with respect to renewable energy and cleaner fossil fuel technologies include technical standards, long-term collaborations and partnership arrangements as well as ways to achieve cost reductions.

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I. Introduction

1. At its fourteenth session, the review session of the second implementation cycle 2006-2007, the Commission on Sustainable Development conducted an evaluation of progress in implementing Agenda 21, the Programme for the Further Implementation of Agenda 21, decisions taken at the ninth session of the Commission and the Plan of Implementation of the World Summit on Sustainable Development (Johannesburg Plan of Implementation), while focusing on identifying constraints and obstacles in the process of implementation with regard to the current thematic cluster. This cluster covers the issues of energy for sustainable development, industrial development, air pollution/atmosphere and climate change. The report of the Commission on Sustainable Development on its fourteenth session[1] includes the Chairman's summary, which reflects the constraints and obstacles, and possible approaches and best practices for the implementation of those intergovernmental agreements, as well as the way forward identified by the ministers attending the high-level segment.

2. At its fifteenth session, the Commission on Sustainable Development will take policy decisions on practical measures and options to expedite implementation for the selected thematic cluster of issues, taking into account the discussions of the intergovernmental preparatory meeting, reports of the Secretary-General and other relevant inputs. The present report is a contribution to the Commission's discussions on policy options and possible actions to address the constraints and obstacles in the process of implementation identified in the report of the review session with regard to energy for sustainable development. The other issues of this thematic cluster and the cross-cutting issues identified at the eleventh session of the Commission are addressed in the relevant reports (E/CN.17/2007/3-6). Since the issues are interlinked, references to them are included in the present report.

3. The present report draws on a number of sources, including national reports and case studies submitted by Member States, the outcomes of regional implementation meetings and contributions of UN-Energy, major groups and secretariats of various United Nations convention bodies. As the four issues of this thematic cluster are closely linked, the relevance of these interlinkages for policy options is considered in the report on cross-cutting issues (E/CN.17/2007/6). Although the cross-cutting issues identified at the eleventh session are considered throughout the present report, many are addressed in the report on cross-cutting issues as well.

II. Access to energy

4. A combination of supportive policies at the national, regional and international levels, coupled with the commitment of necessary resources, could contribute significantly to providing access to modern energy services for cooking, heating and electricity in order to meet basic human needs and facilitate achievement of the Millennium Development Goals. At the national level, integrating and prioritizing energy-access policies for the poor into other policies and reflecting them in national sustainable development strategies, development plans and poverty reduction strategies has been shown to advance policy coherence and effectiveness.

[1] *Official Records of the Economic and Social Council, 2006, Supplement No. 9* (E/2006/29).

The experience of the Economic Community of West African States has shown that countries can cooperate regionally to give a high priority to energy access in their development plans and benefit mutually from harmonized policies and the sharing of energy resources. International support for technical assistance could be provided for the development of appropriate technical standards, planning and data gathering, and the design and implementation of financial instruments to support the development, expansion and/or refurbishing of electricity infrastructure.

5. A range of policy options and possible actions exist to lower the cost of extending grid access, bring down the cost of off-grid technologies and address the reliance on inefficient biomass cooking and heating, as the experiences of China and India show. The variety of conditions prevailing in rural areas and urban slums calls for a mix of policies and measures tailored to each case. In rural areas, possible actions include encouraging the use of modern fuels, such as kerosene and liquid petroleum gas. The adoption of simplified and low-cost transmission and distribution options in Tunisia and a focus on efficiency and economies of scale in South Africa have contributed to the success of electrification programmes in those countries. Successful programmes to extend the grid have been accompanied by policies that emphasize careful assessment, the setting of realistic goals and clear assignment of responsibility. Affordability can be addressed through policies that promote cost-sharing of grid access, such as using cross-subsidies, with a mixture of public finance, including donor grants and contributions from the beneficiaries. For certain types of consumers, such as poor households, connections could be partially subsidized.

6. A number of proven policies and possible actions are available to provide electricity access for stand-alone and mini-grid situations. Such policies and actions based on renewable energy sources could be particularly effective in small island developing States, as the experiences of Barbados and Cyprus have shown. In many countries, priority is given to electrifying such central points as clinics (for the refrigeration of medicines), schools, government offices and community centres. Targeted subsidies have been used to offset the high upfront cost of equipment, such as solar home systems. Related policy options include the promotion of local assembly and manufacturing, such as of solar water-heating systems, and allowing duty-free import of equipment and components. Measures and policies that strengthen community participation for the establishment, financing, operation and maintenance of decentralized electricity systems have been successfully implemented in a number of countries. A practical option in this regard is the establishment of rural energy funds or other financing mechanisms for the scaling-up of successful models for the provision of affordable, clean energy services, such as the rural electricity cooperatives that have been employed in Bangladesh. There is considerable scope for expanding existing international cooperation in relation to such technologies as minihydropower and biogas systems, in which certain developing countries lead the field, as well as building institutional and managerial capacity.

7. Lighting is an important issue for the rural and urban poor, not only with regard to extending hours of education and production but also for night-time pedestrian safety and such medical emergencies as child birth. Low-cost and energy-efficient lighting systems are available, such as solar lanterns and light-emitting diode and compact fluorescent lamp systems that can be powered by solar

energy. Programmes which make these technologies available to the poor could have a significant impact on the lives of poor women and children.

8. The experience of a number of developing countries has shown that rural energy policies can contribute more effectively to poverty alleviation if they facilitate income generation and the ability to develop micro- and small-scale industries. This implies that services need to be targeted at entrepreneurs and that suitable technologies need to be available. Examples of microenterprises providing energy services include battery and mobile phone charging services, small-scale agroprocessing and food preparation and the renting of solar lanterns. The multifunction platform that has been successfully employed in Mali provides affordable energy for milling, dehusking and water services, as well as for welding and battery charging. Nearly all of the clients are women.

9. In some developing countries, transmission and distribution losses are a major source of inefficiency in the electricity sector. Although technical losses can be minimized by the use of higher efficiency transformers and capacitors and the installation of improved control technologies, as well as the use of higher voltage lines, much of the loss is owed to theft and inadequate billing methods. Thus, a system that provides electricity to the poor would reduce the risk of unmetered electricity being accessed, and better metering and billing practices would improve the economy of electric power delivery.

10. Policies for the urban environment in developing countries generally address the affordability of clean, modern energy services. Slum upgrading and the associated provision of services offer an opportunity to increase access to modern energy services. Accordingly, appropriate policies and measures could be integrated into urban development planning, including by involving the utilities at an early stage. Government policies to regularize the rights of tenancy or occupancy, where legal title is unclear, have been shown to facilitate private investment and may encourage utilities to provide services. Policies to reorient existing subsidies from the general consumer to the poor consumer could also improve access, while also contributing to the financial viability of service providers. A policy option employed in a number of countries consists of providing a minimal amount of electricity at no cost or at a low cost through lifeline or graduated tariff rates, as is done in India and South Africa.

11. Cost and capacity constraints could be reduced by enhancing the enabling environment for small-scale suppliers of energy services that would include the installation and maintenance of equipment. In some countries, procurement for public works is geared to promoting the participation of small-scale providers and minorities. In several cases, loan guarantees have been employed to encourage private sector participation in providing energy services for the poor, including small-scale projects. These have been successful especially when undertaken in combination with training on ways to secure financing. Reducing risks faced by local entrepreneurs and banks/financiers could expand services available to communities. At the international level, as demonstrated by the experience of Egypt in the energy service company area, there is considerable scope for cooperation, sharing of experiences and assistance with respect to urban planning and electrification schemes. In recognizing the important responsibilities of municipal governments with regard to energy access, international organizations and international financial institutions could increase technical assistance to them.

Cooperative action could be undertaken through existing channels, such as the Slum Upgrading Facility of the United Nations Human Settlements Programme.

12. Where traditional fuels still dominate, the switch to more efficient modern energy services could be encouraged by lowering or eliminating taxes on more efficient modern fuels, with subsidies as an option to address affordability for the poor and the negative externalities generated by deforestation. Taxes on liquid petroleum gas and electricity ought to be avoided if they inhibit more affluent users from switching from fuelwood. Such policies could be especially important when energy prices are relatively high and discourage fuel switching to modern energy services. Targeted subsidies may be appropriate if they reduce the fixed costs associated with energy use, such as when applied to the purchase of cookstoves and other appliances, rather than lowering the recurring costs of fuels and electricity. Awareness-raising campaigns promoted through the health sector, in the media and in schools and undertaken with international and non-governmental organization support could assist in overcoming lack of technical and financial information on modern energy services and how they can be accessed.

13. Many of the policies geared to improving access to cleaner cooking and heating fuels are of particular benefit to women, who, along with children, are most likely to suffer from the health consequences of indoor air pollution and to spend time gathering fuel. In choosing from a menu of options, policies could be designed to ensure optimal co-benefits, including more time for child-rearing, increased economic opportunities and better access to health services and education. This context highlights the importance of integrating the concerns of women and children into overall energy planning and of linking access to energy for women with income generation and enterprise development opportunities. Budgeting processes that identify impacts according to gender and use needs assessments are tools that could be applied to ensure integration of these concerns. Training for women to become energy technicians and producers of simple energy technologies could increase the ability of women to contribute to energy-access solutions.

14. Some regions are endowed with considerable energy resources, but these may be concentrated in particular subregions or countries. Regional and cross-border cooperation can not only contribute to improving access to energy but also enhance energy security. Africa has abundant hydropower potential largely concentrated in the central areas, coal in the southern areas and oil and gas primarily in the northern areas and along the central Atlantic coast. Experience in other regions has shown that the development of cross-border energy infrastructure can assist in overcoming energy shortages, enhance industrial development and improve environmental performance. This approach is included in the New Partnership for Africa's Development with regard to energy trade. Thus, regional programmes to interconnect national power grids and jointly develop hydropower resources could contribute significantly to increasing access to electricity. Interconnection initiatives with power-sharing arrangements could also reduce the costs faced by small, fragmented power markets. The West African gas pipeline, for instance, will supply gas from fields in Nigeria (where some of it would otherwise be flared) to Benin, Togo and Ghana, replacing the more expensive and polluting oil currently used for power generation, and opening the opportunity to use compressed natural gas for vehicular transportation.

15. Many developing countries, including the least developed countries, could benefit domestically and regionally from the development and use of local gas deposits and of gas associated with oil production that have been considered uneconomical for the export market. An international arrangement to assist least developed countries in developing stranded natural gas reserves for local consumption is an option that could provide those nations with much needed energy, as well as economic and environmental benefits compared to currently deployed options.

16. International support can play a role in promoting access to energy by assisting developing countries, in particular least developed countries and small island developing States, in tapping infrastructure grant and loan facilities, providing technical assistance to State-owned energy enterprises and strengthening public sector firms that are active in the energy sector, as well as in designing effective public/private partnerships. Such support would facilitate concrete action, given the general consensus that the public sector will continue to be critical in the provision of the infrastructure needs of many developing countries, including to promote access by the poor to modern energy services. At the same time, good practices in the management of State-owned enterprises as well as regulatory and other reforms, including in relation to tariffs and subsidies, could ensure that the poor derive tangible benefits from increased public and private investment.

III. Energy efficiency

17. The co-benefits from implementing energy efficiency measures are numerous, including reduced costs, reduced energy demand, improved air quality and reduced greenhouse gas emissions. However, market-related and institutional barriers need to be overcome and improved energy efficiency technologies need to be made available to promote the adoption and use of energy efficiency measures. Greater international cooperation and further access to financing and technology transfer will be important for mobilizing energy efficiency investments in developing countries. Considerable scope exists for international technical assistance to assess and provide advice on opportunities to improve energy efficiency in all sectors, which could be coupled with concessionary or grant financing to implement recommended improvements.

18. Improving energy efficiency in industry and reducing local air pollution remain a major challenge at the national level, but a range of policy options exist that have successfully supported transitions to more energy-efficient economies in many countries. These options include benchmarking, energy auditing, negotiated agreements between Governments and industry, standards for more efficient motors, cogeneration for heat and power and using the by-products from industrial waste streams as inputs into other industrial processes. The potential for efficiency gains is particularly great in rapidly industrializing countries and in countries with economies in transition. Measures, such as benchmarking and partnerships for sharing expertise, have been employed in energy-intensive industries, including aluminium smelting and cement production. Cement production, which takes place in most countries, is particularly energy intensive, accounts for 5 per cent of annual global carbon dioxide emissions and can be a major source of local air pollution. As a programme of the World Business Council for Sustainable Development, the cement sustainability initiative, which was launched to improve performance in a

number of areas, including to reduce fuel use and emissions, could be a model for other energy-intensive industries.

19. In order to support implementation of many of these options, Governments could consider fostering the development of energy service companies to provide technical advice and related services. Experience in countries where energy service companies have been established has shown that they provide valuable technical advice and act as important promoters for industrial modernization, productivity gains and economic development. Experience has shown that providing financial support through partial loan guarantees to commercial lenders for energy service company projects and providing business development support to energy service company start-ups are practical measures that could be considered in establishing such service companies.

20. The modernization, rehabilitation and expansion of electricity sector infrastructure provide significant opportunities for achieving energy efficiency improvements. Possible actions, such as improved maintenance and upgrading, could bring about cumulative improvements in power plant efficiency. Switching to cleaner and more efficient technologies, such as cogeneration of heat and power, could yield large efficiency gains, while fuel switching from coal to natural gas could produce both energy efficiency and climate change benefits. Interconnection of national electricity grids into regional power pools is an option that might, for example, allow the sharing of the highly efficient hydropower production of one country while at the same time greatly enhancing stability of supply for all interconnected countries. Regionally liberalized and expanded electricity trade could also realize energy efficiency gains through improved utilization of generating capacity, leading to reduced emissions.

21. Efforts to modernize the extraction and processing of hydrocarbons also offer opportunities for energy efficiency gains, in particular in the downstream refinery industries of countries with economies in transition. Given that many oil and gas producing and exporting countries require access to advanced technology to improve efficiency of extraction and refining processes, policies to facilitate investment and access to technology could contribute significantly to reducing greenhouse gases. The Global Gas Flaring Reduction Partnership of the World Bank is trying to confront the huge planning efforts and infrastructure investments needed to achieve significant reductions in gas flaring and venting. Possible actions that could be considered to support those efforts include dissemination of best practices and capacity-building.

22. Energy consumption in the transport sector is increasing rapidly, a trend that is expected to continue. A range of policy options and possible actions are available to develop and deploy cleaner and more efficient vehicles. On the demand side, policies and measures could be designed to influence consumer behaviour, for instance through vehicle fuel-economy standards, insurance pricing, vehicle financing or the imposition of higher taxes on less fuel-efficient vehicles and on gasoline. Policies such as public fleet procurement have been employed to accelerate market development of more efficient and cleaner vehicles, such as bus fleets operating on compressed natural gas. An important regulatory option is the setting of standards for vehicle fuel efficiency, which can have a major impact on transport energy consumption. Public-private research partnerships and initiatives that promote the introduction of fuel-saving tyres and decrease the cost of

lightweight, very strong carbon-composite materials for vehicle construction constitute practical measures for addressing efficiency in the transport sector.

23. Energy consumption in buildings has also been growing rapidly, with current construction methods and standards determining consumption for decades to come. Effective use of locally available insulation materials, use of natural daylight, energy efficient and natural ventilation and other measures could significantly reduce space heating, cooling and other operational costs in buildings. At the regional level, the European Union has adopted a directive on the energy performance of buildings that requires its member States to implement a range of provisions aimed at improving energy performance in residential and non-residential buildings, both new and existing. Possible options for improving energy efficiency include policies for building codes and design standards and best practices guidelines. In many cases, such policies are adopted at the local or municipal level, based on model codes and taking into account the availability of building materials and prices, local climatic and soil conditions and other factors. In several countries, programmes offering incentives for retrofitting existing buildings, certification schemes and public awards for distinguished architects, designs and "green" buildings have contributed significantly to awareness of the economic advantages of energy efficiency. These may also be applicable in small island developing States to improve energy efficiency in the tourism sector.

24. Creating increased awareness of the long-term advantages of energy efficiency and promoting cooperation among architects, policymakers, municipalities, building developers, owners and tenants is a further practical measure that could increase the energy efficiency of the built environment. One option for achieving this is through active energy efficiency partnerships and international cooperation among concerned professional associations, municipalities, city officials and other energy policymakers. International technical assistance could be provided to help in the elaboration of appropriate technical standards, model building codes and best practices guidelines in developing countries and in countries with economies in transition. The Marrakech task force on sustainable building and construction could be one useful vehicle for international sharing of experience and best practices.

25. The significant benefits that can be achieved by programmes supporting the introduction of energy-efficient appliances, lighting and equipment are becoming widely known and are stimulating market demand for such products. An array of policy options and possible actions, such as minimum energy performance standards, negotiated agreements between industry and Governments, and demand-side management activities focusing on, among other things, introduction of such efficient lighting products as compact fluorescent light, have all proven to be effective tools for reducing electricity consumption and greenhouse gas emissions. Well-designed energy efficiency labelling schemes help to inform consumers, thereby facilitating the selection of sustainable products. Another matter for possible action that is beginning to receive the attention of policymakers is standby power consumption. In this regard, the 1-watt initiative of the International Energy Agency, which brings together equipment manufacturers, policymakers and other stakeholders to reduce standby power consumption to an acceptable minimum, provides an option for all stakeholders.

26. Efforts to facilitate international trade in energy-efficient products could greatly benefit from expanded international cooperation in the harmonization of

energy efficiency testing protocols. Technical assistance for the establishment of testing laboratories, whether at the national or regional level, could be a complementary practical measure. International partnerships, such as the collaborative labelling and standards programme and the efficient lighting initiative, as well as new "communities of practice" such as the compact fluorescent light initiative, a similar initiative for consumer electronics, and the Standards for Energy Efficiency of Electric Motor Systems initiative, are ongoing actions that could benefit from support and serve as models for possible actions to increase the energy efficiency of consumer products.

IV. Cleaner energy technologies

27. Strengthening the development, use and transfer of cleaner energy technologies, especially renewable energy and advanced energy technologies, is crucial to improving access to modern energy services, to improving the efficiency with which energy is produced and used and to significantly reducing atmospheric emissions. In fact, in addition to improving industrial productivity, a major drive for developing and deploying cleaner energy technologies is the need to reduce the emission of atmospheric pollutants, in particular greenhouse gases, that contribute to climate change.

28. A major problem with most of the cleaner energy technologies is cost. Together with increasing the scale of deployment, research and development are essential tools for reducing this cost. Thus, an important policy involves support for research and development of cleaner energy technologies. For potentially important technologies that appear to require long periods of development, international partnerships and public-private partnerships could accelerate development as well as permit a broader sharing of the resulting technology. A policy that supports education in science and technology can ensure the necessary technical capacity to participate in the development and application of these new technologies.

29. For the well-established cleaner energy technologies, the key to accelerating their deployment lies with lowering their cost. There are two approaches to achieving the necessary cost reductions, namely, increasing the scale of deployment so as to reduce unit cost through economies of scale, and conducting further research and development to decrease the cost of production and/or to improve system performance. Most of the policy options and possible actions considered in section IV of the present report are expected ultimately to contribute to achieving cost reductions.

30. The equipment, infrastructure and skills necessary for the deployment of these technologies do not exist in many developing countries. Therefore, combating climate change and reducing air pollution calls for long-term collaboration between developed and developing nations in advanced energy technologies, including through capacity-building and technology transfer.

31. While the deployment of renewable energy technologies for off-grid applications is an important option for providing access to modern energy services in remote areas and small island developing States, it is their large-scale deployment for grid power that will make a significant contribution to a diversified energy mix and to a reduction in greenhouse gas emissions. The large-scale deployment of renewable energy technologies has been promoted by such policy instruments as tax

credits and favourable feed-in tariffs. It is important that these instruments be stable and predictable. Those countries that have enacted legislation to promote the use of renewable sources of energy, such as by establishing a minimum proportion of energy to be produced from renewable sources, and that have established tariff and other regulations for grid-connected electricity have been successful in accelerating the deployment of these technologies. China and many countries of the European Union offer examples of success in this regard. Tradeable renewable energy credits, combined with renewable energy portfolio standards, can be a relatively low-cost policy option for promoting wider adoption. The dissemination of many of the technologies, in particular for power from wind and solar energy, could be further advanced through the sharing of experiences and lessons learned in addressing environmental and aesthetic concerns. Technical, operational and regulatory standards for grid integration owing, inter alia, to the intermittency of resource availability, could also be elaborated in the framework of international cooperation.

32. The transformation of biological feedstocks into fuels is of growing interest with regard to both expanding fuel supplies and providing cleaner fuels. The primary biofuels currently produced are ethanol, as a substitute for gasoline, and plant oil products that can substitute for diesel fuel. With biofuels being of interest as alternate fuels in all countries, including in small island developing States, there is some expectation that they could be produced for export by agriculture-based developing countries, although there are concerns about restrictive trade practices. While the availability of the land needed for producing biofuels can also be an issue, some of these fuels can be produced from waste biomass. Now that national and/or regional associations to promote biofuels have been formed on every continent, one option to accelerate the switch to these fuels is support for a forum where Government policymakers and technical experts can share their experiences with these fuels and seek assistance in the development of national biofuel strategies that cover the needed regulatory and policy framework, infrastructure and investments. Building on the experience of and support from India, West African countries are utilizing the jatropha plant for biofuel production and looking at innovative ways to leverage financing for increasing production.

33. While tapping renewable sources is effective in reducing greenhouse gas emissions, the limited scale of deployment of renewable energy technologies to date necessitates continued extensive reliance on fossil fuels. There are three approaches to reducing greenhouse gas emissions, while maintaining the same energy delivery from fossil fuels, namely, promoting: (a) advanced and cleaner fossil fuel technologies that improve energy efficiency and/or produce reduced emissions; (b) a switch to fuels that emit less carbon dioxide, such as natural gas and the biofuels mentioned above; and (c) the deployment of technologies for capturing and storing or reusing the carbon dioxide emitted by power plants.

34. The deployment of advanced, cleaner and more efficient fossil fuel technologies could be facilitated by arrangements that would make available to many producer countries advanced oil production and refining technologies and advanced clean coal technologies, such as supercritical pulverized combustion and integrated gasification combined cycle plants. One type of arrangement, including partnerships with developing countries in the development and deployment of those technologies, is an option that could expand the market for the technologies and thereby reduce unit price.

35. Options for promoting natural gas include the development and expansion of liquid natural gas projects and the development and deployment of gas-to-liquid technologies, such as will be used in the facilities under development in Qatar. Other options relate to supporting projects to construct gas pipelines and to using natural gas associated with oil reservoirs that is currently being flared, such as is being undertaken by the Global Gas Flaring Reduction Partnership of the World Bank.

36. All the individual elements needed for carbon dioxide capture and storage systems have been demonstrated, and the next step towards commercialization involves the construction of integrated full-scale demonstration plants. Carbon dioxide capture and storage is critical for fulfilling coal's potential to provide continued low-cost electricity in developing countries as concerns over carbon dioxide emissions grow. Since such power plants cost significantly more than standard coal-fired power plants, deployment could be facilitated by supportive policies and the results of further research and development. There are fewer than two dozen countries that rely heavily on coal as an energy source, including several large industrialized and developing countries. Policy options and possible actions for accelerating the capture of carbon dioxide are those that could facilitate and support arrangements among these countries for sharing technology and know-how to retrofit, where feasible, existing coal-fired power plants and to deploy plants with built-in carbon dioxide-capture capability. For example, the FutureGen Alliance is a public-private international partnership established to demonstrate the option of zero-emission coal-fired power generation, with associated production of hydrogen.

37. In addition to the policy options and possible actions concerning greenhouse gas emissions described in the report on climate change (E/CN.17/2007/5), carbon dioxide in large quantities is being considered as a resource for enhancing oil extraction. While the technique of injecting carbon dioxide has been in use for more than three decades to maintain production in mature oil fields, state-of-the-art developments of this technique are increasingly being considered and used as the number of mature fields expands. A partnership that would include representatives of major petroleum and carbon dioxide-emitting industries could promote and facilitate the rational use of carbon dioxide as a resource for enhanced oil recovery and for the eventual storage of that carbon dioxide in capped depleted oil reservoirs.

38. As a major greenhouse gas, methane can be recovered and used as fuel. Thus, similar partnership options could be considered for expanding the deployment of the technologies used for the capture of methane from coal mines, oil production, landfills and such biological sources as peatlands and marshes. One example is the Methane to Markets Partnership, an international initiative that advances cost-effective, near-term methane recovery and use in order to reduce global methane emissions, enhance economic growth, strengthen energy security, improve air quality and improve industrial safety.

39. As concerns about climate change have increased, nuclear power generation, which produces no direct greenhouse gas emissions, is an option being considered by some countries. Although the choice of nuclear energy rests with countries, as recognized by the Commission on Sustainable Development at its ninth session,[2] there is continued public concern over the challenges with respect to safety, security,

[2] See *Official Records of the Economic and Social Council, 2001, Supplement No. 9* (E/2001/29).

spent fuel and radioactive waste management, and the proliferation of fissile materials. For those countries that choose nuclear energy, the International Atomic Energy Agency provides a forum for promoting international cooperation in the peaceful use of nuclear energy.

40. The primary option for technologies still under development is continued support for research, development and demonstration projects. Hydrogen energy technologies and fuel cells are technologies that fall into this category. The newly established International Centre for Hydrogen Energy Technologies of the United Nations Industrial Development Organization, in Istanbul, Turkey, and the International Partnership for the Hydrogen Economy, currently involving 16 countries and the European Community, provide options for accelerating the development and deployment of hydrogen energy systems. Hydrogen energy systems could be particularly effective in small island developing States that are endowed with such renewable sources of energy as geothermal energy and hydropower.

41. The increased use of cleaner energy technologies in developing countries could be facilitated by policy options and possible actions designed to promote trade in cleaner energy devices and systems, technology transfer agreements, support for national efforts to build organizational and manufacturing capacity, innovative financing and credit mechanisms and more involvement from the private sector. With regard to renewable energy technologies, local assembly and manufacturing of equipment could, under the right conditions, also lower costs and could be promoted by supporting national efforts to build organizational and manufacturing capacity.

42. The development agenda under discussion in the World Intellectual Property Organization could enhance the intellectual property rights framework pertaining to technology transfer, including clean energy technologies. Partnerships that involve developing countries in the development and deployment of advanced energy technologies could contribute both to the transfer of relevant technologies and the building of necessary capacities. They also could contribute to expanding the market for these technologies, with the added benefit of reducing production costs owing to economies of scale. An example of an international initiative to assist developing countries in a shift towards cleaner fossil-fuel technologies is the agreement between the European Union and China to cooperate in the construction of a demonstration coal-fired power plant that incorporates carbon dioxide capture and storage technology.

43. The sharing of technologies, especially through joint ventures, has proved to be an effective way of accelerating the use and transfer of cleaner energy technologies. An example is the Danish-Chinese joint venture to establish wind farms in China, which has helped to reduce the manufacturing cost per unit by increasing the scale of production. Moreover, by shifting the manufacture of the wind turbines to factories in China, a further reduction in unit cost was realized, local employment increased and China was able to join Denmark in entering the international market for this technology.

44. The technological strengths that exist in developing countries for a number of renewable energy technologies, such as the ethanol programme in Brazil, suggest that an opportunity exists for the establishment of a cost-effective South-South cooperation programme with international support to accelerate the deployment of these technologies for the provision of energy in other developing countries, in

particular the small island developing States and least developed countries. Other examples include the solar water heating technologies developed in Barbados and India, among other countries, and the biogas technologies of China and India.

45. Experience shows that dedicated financing agencies that seek external funds and make them available as loans for local renewable energy projects, such as the Indian Renewable Energy Development Agency, can accelerate the adoption of renewable energy technologies. Such agencies can also enable the leveraging of finance from domestic private-sector sources. Aside from financing, agencies of this kind can play an important role in facilitating and stimulating the market for renewable energy systems through measures such as renewable energy resource assessments and raising public awareness.

46. International and regional initiatives can contribute to accelerating the deployment and lowering the cost of cleaner energy technologies. Continued cooperation and discussions in regional forums would strengthen the exchange of experiences in the development and application of cleaner energy technologies among developing countries. Cooperative research and development programmes on cleaner energy technologies, including joint development projects, is a productive way of advancing the technologies, of adapting devices and systems to conditions in developing countries and of building local capacity. A number of partnerships and networks have been established which facilitate the sharing of information on these technologies, such as the "100% renewable energy islands" initiative. Consideration could be given to supporting implementation of General Assembly resolution 60/199 to promote new and renewable sources of energy by establishing a world renewable energy programme, similar to the recently concluded World Solar Programme 1996-2005, but potentially incorporating some of the options mentioned above, as well as by regularly evaluating available data to review progress being made in achieving the renewable energy goals contained in paragraph 20 (e) of the Johannesburg Plan of Implementation.

V. Policy options and possible actions at the international level

47. **The policy options and possible actions that can be considered at the international level to support implementation efforts for energy for sustainable development include:**

Increasing access to modern energy services

(a) **Increasing the engagement of countries at the regional level, including through the establishment of regional policies, to give a high priority to energy access in their development plans, with international support for such regional activities as efforts to interconnect national power grids;**

(b) **Utilizing microcredit schemes for users of modern cook stoves, and for cooking and heating fuels;**

(c) **Expanding initiatives by development partners and international financial institutions to strengthen financial markets in order to assist in designing and issuing financial instruments to support the development, expansion and/or refurbishing of the electricity infrastructure;**

(d) Supporting efforts to enhance technical capacities in State-owned energy enterprises;

(e) Supporting the establishment and strengthening of energy service companies through capacity-building;

(f) Increasing support for national efforts, such as financing with cross-subsidies, to provide electricity services to rural areas, including off-grid power based on renewable sources;

(g) Considering international arrangements which would assist least developed countries in the development of small local natural gas reserves and infrastructure for domestic use;

Improving energy efficiency

(h) Increasing the support of development partners and international financial institutions for existing programmes which benchmark and share expertise, in particular in energy-intensive industries;

(i) Increasing international support for national efforts to adopt standards and labelling for energy-efficient appliances, lighting, motors and consumer equipment, as well as harmonization of international testing methods;

(j) Increasing support for information exchange and expanded capacity-building on legal and regulatory frameworks to promote energy efficiency;

(k) Providing further support for the World Bank Global Gas Flaring Reduction Partnership;

(l) Expanding multi-stakeholder partnerships to enhance concrete collaboration to improve energy efficiency in transport;

Strengthening the development, use and transfer of clean energy technologies

(m) Supporting information-sharing activities and providing technical assistance for the development of national biofuel strategies in developing countries, including small island developing States;

(n) Increasing technology cooperation programmes, with international support, to accelerate the diffusion of renewable energy technologies, such as in the areas of solar photovoltaic and thermal energy, wind power, small-scale hydropower, geothermal energy, mini-hydropower and biogas, including through South-South cooperation;

(o) Implementing General Assembly resolution 60/190 to promote new and renewable sources of energy by considering the establishment of a world renewable energy programme, similar to the recently concluded World Solar Programme 1996-2005;

(p) Considering the establishment of a mechanism for regularly evaluating available data to review progress being made in achieving the renewable energy goals of paragraph 20 (e) of the Johannesburg Plan of Implementation;

(q) **Strengthening technology cooperation on advanced clean coal and carbon dioxide capture and storage technologies, including establishing cooperative partnerships to assist the major coal-consuming countries that are not members of the Organization for Economic Cooperation and Development to facilitate the transfer of the advanced, clean coal technologies needed to significantly reduce current and future air pollution and, to a lesser extent, carbon dioxide emissions.**

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Policy options and possible actions to expedite implementation: industrial development

Report of the Secretary-General

Summary

Industrial development has rarely occurred by virtue of free market forces alone. Government policies and investments have played an important supportive role. Policy choices are best informed by country-level diagnostics of key constraints, and Governments do have policy space to promote industrial development, diversification and upgrading, even if somewhat constrained by historical standards.

Trade can help boost industrial development, both through access to imported technologies and intermediate inputs and through the scale and learning economies of access to global and regional markets. Thus, openness of the international trade regime to developing country industrial exports is an important enabling condition.

Public investment in basic infrastructure, research and development, and education can support industrial development, especially as industries become more knowledge-intensive. Public support to venture financing can encourage greater risk-taking by entrepreneurs in exploring new product markets. Measures to encourage investments by the private sector in training of the workforce, including through public-private partnerships, can be important to facilitating technology transfer. In many situations, the specific challenges facing small and medium-sized enterprises (SMEs) — e.g., limited access to formal credit markets, weak managerial and technical know-how, poor information about markets — can be remedied through targeted government programmes and through initiatives of industry associations.

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Governments generally have basic legislation to protect the rights of workers and to safeguard the environment, but many face difficulties with implementation. The internalization by enterprises of principles of corporate social and environmental responsibility and accountability can help relieve the enforcement burden on Governments, as can an active civil society. Still, Governments would benefit from technical assistance to strengthen monitoring and enforcement capacity of workplace and environmental regulations. The use of economic instruments could in many cases help achieve sustainable industrial development goals most efficiently.

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I. Introduction

1. At its fourteenth session, the review session of the second implementation cycle 2006-2007, the Commission on Sustainable Development undertook an evaluation of progress in implementing Agenda 21, the Programme for the Further Implementation of Agenda 21, the decisions taken at the sixth session of the Commission and the Plan of Implementation of the World Summit on Sustainable Development ("Johannesburg Plan of Implementation"), while focusing on identifying constraints and obstacles in the process of implementation with regard to the current thematic cluster. This cluster covers the issues of energy for sustainable development, industrial development, air pollution/atmosphere and climate change. The report[1] of the review session includes a chairperson's summary that reflects the constraints and obstacles, and possible approaches to and best practices for the implementation of these intergovernmental agreements, as well as the way forward identified by the Ministers attending the high-level segment.

2. This report is a contribution to the discussions of the Commission on policy options and possible actions to address the constraints and obstacles in the process of implementation identified in the report of the review session with regard to industrial development. Similar reports have been prepared for the other issues of this thematic cluster and, in the light of the interlinkages among the themes, the reports should be read in conjunction with one another. The fifteenth session of the Commission on Sustainable Development will take policy decisions on practical measures and options to expedite implementation for the selected thematic cluster of issues, taking account of the discussions of the intergovernmental preparatory meeting, reports of the Secretary-General and other relevant inputs.

3. This report draws on a number of sources, including national reports and case studies submitted by Member States, the outcomes of regional implementation meetings, and contributions from major groups and secretariats of various United Nations conventions. As close linkages exist among the four issues of this thematic cluster, the relevance of these interlinkages for policy options is considered in a separate report. Although cross-cutting issues identified at the eleventh session are considered throughout the report, many are addressed in this separate report.

II. Fostering an enabling environment

4. A range of policies and practical measures at both the national and international levels could advance industrial development, which is crucial to promoting economic growth and providing sustainable livelihoods. Among the most important international policies are those that ensure unobstructed market access to the exports of developing countries.

5. Addressing market access concerns of developing countries, including tariff escalation, high industrial tariffs in some countries, and the increasing prominence of non-tariff barriers to the exports of low-income countries would help promote industrial development. Free trade access for the industrial and other exports of the least developed countries (i.e., special treatment) takes on added salience as most-favoured-nation tariffs are further reduced. Efforts to reduce tariffs and non-tariff

[1] *Official Records of the Economic and Social Council 2006, Supplement No. 9* (E/2006/29).

barriers in major markets could support the exporters of environmentally friendly goods and services, ranging from renewable energy equipment and biofuels to organic foods.

6. Strengthening aid-for-trade initiatives could help developing countries, particularly least developed countries, to build the supply-side capacity and trade-related infrastructure needed to implement and benefit from World Trade Organization Agreements. One possible international action involves providing financial and technical support to technical institutions that can facilitate compliance with international product standards. This could include the institutes, laboratories and bodies that can ensure that products, particularly of SMEs, are able to meet product quality standards, including sanitary and phytosanitary standards, as well as other requirements for export to markets governed by environmental directives or strong consumer preferences for "sustainable products".

7. At the national level, industrial development would benefit from a framework that addresses four major tasks of policy: (a) diversifying production and exports, enabling firms to cope with entry costs and addressing the coordination problems of developing new sectors; (b) upgrading technologies, organizational set-ups, design, marketing and logistics, enabling entry into more sophisticated sectors; (c) the multiplication of domestic linkages, particularly critical for export sectors and foreign direct investment (FDI); and (d) the promotion of small enterprises, which are generally employment-intensive. Some countries (the East Asian newly industrializing countries, including China) do employ active industrial policies, with some success. Strategic investments in human capital are also important to promoting industrial development with broadly shared social and economic benefits. An adequate regulatory and incentive framework can help steer industrial development along an environmentally sound path.

8. A combination of national policy measures can promote industrial development by supporting quality and productivity improvements and facilitating access to global supply chains and networks. Innovation is best understood in a broad sense as extending beyond new technology development to include technology adaptation, new market discovery and development, organizational innovation, improvements in logistics and other measures that lower transaction costs. Thus, the ability to reap the benefits from new technologies often depends on innovations in distribution and organization occurring simultaneously. A policy framework that combines access to international technology flows with strengthening of domestic innovation capabilities in all these dimensions can be conducive to industrial development.

9. Since what is a new line of business in a particular country may not be new globally and often makes use of existing technologies, measures both to facilitate access to foreign technologies on favourable terms and to strengthen the capacities of domestic firms to absorb them are important. In an effort to increase positive technology spillovers from FDI, proactive policies to promote technology transfer can play an important role. In China, for instance, the Government's technology-transfer requirements for joint ventures have allowed domestic firms to learn from more technologically advanced foreign companies.

10. Government policy can contribute to industrial diversification by reducing the risks involved in new market exploration. Favourable tax treatment for private sector research and development expenditures is one policy option. Government

support to research and development activities for promising new product and process technologies is another, assuming a conducive environment for product commercialization, such as the availability of venture capital financing and suitable protection of intellectual property. Public support to venture capital financing has had a major impact in supporting the development of non-traditional product clusters in Chile, for instance. One option would be for international financial institutions, building on the experience in Chile, the Republic of Korea, and elsewhere, to work with the Governments and private sectors of interested developing countries to build up public or public-private venture capital financing schemes to encourage greater entrepreneurial risk-taking aimed at new market discovery.

11. Experience suggests that policies that foster product diversification, in particular through strong growth of non-traditional exports, can be especially effective in supporting economic growth and rising living standards. Specific export promotion measures can be effective in encouraging diversification towards non-traditional exports with significant innovation content. These can cover a range of measures including tariff-free access to imported inputs, tax concessions, credit subsidies, the provision of serviced land and infrastructure, the development of standards, testing and certification institutions, and government-sponsored export market promotion. As the development of sophisticated products depends to a considerable degree on human capital endowments, investments in education, particularly scientific, technical and managerial education, can be crucial to efforts to enter the market for such products.

III. Enhancing the contribution of the private sector

12. Entrepreneurs in developing countries often lack financing to enter new business areas. Some policy options that address this include partial loan guarantees to encourage private financial institutions to underwrite risky industrial ventures, and favourable regulatory and fiscal treatment of venture capital funds. Many developing countries have employed favourable tax treatment of early investments in new priority sectors. Poorly targeted or overly generous fiscal incentives can, however, be counterproductive, by depriving government of much-needed revenue to finance investment in, for example, economic infrastructure, education and health. Particularly in large countries, measures to promote interregional mobility of capital could be important to achieving more geographically balanced industrial development. Powerful advantages from geographical concentration of industry are often present, which can justify fostering greater geographic mobility of labour to enable workers to move to where the jobs are.

13. Public-private sector dialogue can be effective for informing Governments of key problems facing industry and discussing policy options and practical measures to address them. Such dialogue would benefit from transparency and inclusiveness, to minimize any undue influence of regulated industry on the regulatory processor of insider dealing. Benchmarking can provide comparative information to enterprises and industries regarding their relative performance by various measures. It has been used successfully, for instance, in a negotiated agreement between Government and industry in the Netherlands, in which energy-intensive companies are committed to matching the world's best energy performance. Structured dialogues between the public and private sectors to improve the investment climate

could be set up to mobilize local businesses to target legislative and administrative roadblocks, identify solutions and press for reforms, like the Bulldozer Initiative in Bosnia and Herzegovina.

IV. Upgrading skills and technologies

14. Investments in education and skills development can promote the transition to more innovative, knowledge-based economies. Malaysia and Singapore both offer interesting models that demonstrate ways of supporting skills upgrading through a combination of measures, including a payroll tax to finance skills development, and joint public-private training institutes for specific industries and skills. Developing countries that specialize in labour-intensive manufactures might consider programmes for skills upgrading to support diversification towards more sophisticated products with higher technology content, thereby reducing dependency on labour cost advantages alone and the consequent risk of production relocation to countries with lower labour costs. Incentive schemes to encourage greater investment by firms in training to enhance the skills of their workforces can facilitate technology absorption. Thus, policies and programmes aimed at technology transfer are likely to be more effective when they have a significant skills training component.

15. The more dynamic, skill-intensive sectors of an economy are often ones that employ relatively few poor people. For example, the software and business process outsourcing industries in India and the Philippines employ mostly college graduates. Thus, it is important for poverty reduction that, wherever possible, linkages be strengthened between such dynamic industries and other sectors that employ higher proportions of less educated workers. Such linkages may take many forms. For example, some dynamic agricultural activities create demand for labour-intensive services, such as packing, which can be better remunerated than farm work. In Chile, direct smallholder participation in the fresh fruit export sector is relatively small. Still, owing to the high labour intensity of the agro-processing sector and increased employment and wages in larger farms, both of which employ unskilled labour, the agro-industrial sector has contributed to reducing poverty. For small island developing States, such activities could involve integrating agriculture and industry with tourism through agro-tourism and micro-industries for the tourist market.

16. Also the application of information technology (IT) in the manufacturing and service sectors has the potential to boost both output per worker and total employment. While some of the jobs created may be for skilled workers, as in agriculture, there can be complementarities between skilled and unskilled employment. A policy environment that ensures that domestic firms can benefit from continuous cost reductions in IT equipment could help strengthen competitiveness.

17. Other policy options exist to help ensure a broad sharing of the benefits from industrial development. These include training subsidies and public investments or public-private partnerships to provide technical education aimed at strengthening skills in a range of crafts that can be entry points to the formal job market for those with limited education. Some examples include the construction trades, agro-industries, IT equipment and software maintenance and transport equipment repair.

V. Small and medium-sized enterprises

18. Microenterprises and SMEs could benefit from policy and institutional support to help them gain access to both domestic and international supply chains. Policy options could relate to: the design and creation of SME-supportive legal and regulatory systems; facilitation of SME access to bank credit for investment in productive capacity and working capital; managerial capacity-building; and common provision of market information and promotion services for SMEs, such as through trade fairs and international trade missions. For example, Mexico's programme for industrial integration has established two centres to help SMEs identify supply chain opportunities, upgrade their capabilities, and identify and channel technical support, training and loans. While Governments provide valuable support, there is also an important role for industry associations, especially since they are most knowledgeable about the specific needs of their members. Extension programmes with outreach to women entrepreneurs could also be considered since they own and operate a significant proportion of small enterprises, particularly in the informal sector.

19. International support for SME development in developing countries can help them to compete successfully in national and international markets. In one such effort, the International Finance Corporation and the Canadian International Development Agency are supporting a trade facilitation centre for the Self-Employed Women's Association of India. This Association assists more than 15,000 women artisans in a commercial venture that promotes access to national and global markets. Also, the National Cleaner Production Centres established in a number of developing countries with support from the United Nations Industrial Development Organization and/or the United Nations Environment Programme could be further strengthened to be better able to offer technical, managerial and marketing support to SMEs seeking to introduce sustainable production methods and manufacture products competitive in international markets.

20. Financing of trade by customers or suppliers can be an important means of financial support for industries and in countries where access to credit is difficult, in particular for small and medium-sized enterprises, as the goods produced can be used as security for lenders. While such short-term credit facilities may be vulnerable in the wake of financial crises, in some cases Governments have provided preferential treatment to trade finance in debt rescheduling agreements. Governments could strengthen trade finance by, for example, providing legal standing for electronic documents to facilitate issuance of letters of credit, and for assignment of accounts receivable to facilitate borrowing against those accounts. National development banks in Brazil, Colombia and Mexico provide these types of services to facilitate export financing. Similarly, aid-for-trade initiatives could help developing countries, particularly least developed countries, to build the supply-side capacity and to expand their trade more broadly.

VI. Promoting sustainable patterns of consumption and production

21. The achievement of sustainable patterns of consumption and production (SCP) calls for a fundamental rethinking of the way societies produce, use and dispose of

products. Under the Marrakesh Process, through the work of a number of recently initiated task forces, a large number of possible actions are being considered, including some that effectively use supply chain relationships to support SMEs in their transition to more sustainable production systems, and others that help consumers make more sustainable choices through information dissemination, eco-labelling and the increased role of marketing. Some countries and regions are undertaking major SCP initiatives, notably the European Union (EU) through various environmental directives. Some of these directives have implications for EU trading partners, and developing countries could benefit from access to information and in some instances technical assistance to facilitate needed adjustments to production processes or product designs. Any such initiatives would do well to consider and minimize any adverse impacts on developing countries and their products, particularly those least able to adjust.

VII. Cleaner and more resource-efficient industrial production

22. In order to encourage cleaner and more resource-efficient industrial production, Governments have commonly employed such regulatory means as specific standards and compliance rules. Negotiated agreements with industry are also used in some instances, often backstopped by the prospect of mandatory regulation. Market-based instruments have also been used, including taxes and fees to raise the cost of unwanted waste outputs, strict enforcement of liability rules related to pollution or hazardous materials, and subsidies to stimulate cleaner technology development and adoption. Governments could also promote more sustainable production processes through the use of information strategies, such as public disclosure of industry environmental performance. Examples include the Pollution Release and Transfer Registers used in Australia, Canada, the United Kingdom of Great Britain and Northern Ireland and the United States of America, mandatory environmental reporting required in Denmark, and the Programme for Pollution Control, Evaluation and Rating employed in Indonesia. Other options include eco-labelling schemes and the organization of cleaner production competitions with high profile awards. Governments could also promote the adoption of accounting methods that explicitly measure the environmental and social costs of production, thereby better informing managerial decision-making.

23. One promising model for addressing industrial waste streams and, in particular, hazardous waste management has been adopted by the Government of Australia, which has enacted a legal framework and policies that address all aspects of industrial waste management, including generation, storage, handling, treatment, transport, recovery, recycling, reclamation and reuse. Since hazardous waste treatment facilities can be costly, Governments could choose to encourage the establishment of common treatment facilities shared by multiple enterprises in a given geographic area, with operating costs covered from waste charges. Public-private partnerships, possibly involving low-interest loans or loan guarantees, could be used to facilitate construction.

24. Hazardous substances are also a concern in the workplace. Governments are well positioned to support a healthy and safe work environment, including through requirements of equipment design, employer-provided protective gear, well-functioning environmental-risk monitoring and emergency response systems, and in-plant health and safety committees. Corporations bear responsibility for the sound

management of industrial hazards, by informing workers and the public of risks, and involving workers and their organizations, as well as adjacent communities, in decision-making on risk management and reduction. One example involves the footwear industry in Viet Nam, where a partnership between Viet Nam Chamber of Commerce and Industry, local trade associations and international buyers has engaged almost two thirds of footwear manufacturers in efforts to raise health and safety standards. By raising worker productivity and reducing absenteeism and turnover, there was a significant benefit to Viet Nam in increased international orders.

VIII. Corporate environmental and social responsibility and accountability

25. Within the private sector, global supply chains are an increasingly important transmission mechanism for codes of corporate environmental and social responsibility and accountability. Many of the multinational corporations, which are members of, for example, the United Nations Global Compact and the Global Reporting Initiative, work with their suppliers, including those in developing countries, to align their management practices with such codes. Often, adherents to such codes of conduct are industry leaders in sectors with high public visibility, either because they are producing consumer products for socially and environmentally aware consumers or because they operate in industries with potentially large social and environmental impacts, such as the extractive industries. The reach of corporate environmental and social responsibility and accountability practices within and across sectors could be further expanded. To the extent that corporate environmental and social responsibility and accountability breeds financial success, this could occur as a matter of course, but government policy can assist through the encouragement and enforcement of ethical, environmental and governance standards for all corporate entities.

26. For developing countries, encouraging corporate environmental and social responsibility and accountability is one possible action to help domestic enterprises gain access to international markets, improve regulatory compliance and enforcement, support achievement of social and environmental goals, and enhance modernization of production processes and management systems. One approach could be a tripartite agreement such as the one involving the Cambodian Government, the garment industry and the International Labour Organization to implement a countrywide programme that monitors factory compliance with minimum labour standards. Strongly encouraging foreign investors to adhere to a widely recognized CSR code, such as the Tripartite Declaration of Principles concerning Multinational Enterprises and Social Policy of the International Labour Organization, could be another policy option. Support could be provided to SMEs to enable them to align with the CSR policies of their international consumers. In this regard, one policy option would be to subsidize partially the cost to SMEs of CSR certification, and one practical measure would be to strengthen the Marrakesh task force on sustainable enterprises as a mechanism for international experience-sharing on how best to facilitate the linking of SMEs to sustainable global supply chains.

IX. Policy options and possible actions at the international level

27. **Policy options and possible actions that could be considered at the international level to support developing countries' efforts to achieve industrial development include:**

- **Working towards a multilateral trade regime that provides greater opportunities for developing countries to expand their industrial and other processed exports and to diversify and upgrade their export product mix;**
- **Building trade and production capacity in developing countries, particularly least developed countries, to enable them to respond with an effective supply to new export opportunities;**
- **Strengthening capacities of developing country Governments to support the structural transformation and diversification of their economies through a variety of policies and institutions aimed at building technological and entrepreneurial capabilities;**
- **Encouraging the international financial institutions to work with the Governments and private sectors of interested developing countries to build up venture capital financing schemes to support new market discovery;**
- **Supporting the educational and training systems of developing countries in the creation of skilled workforces capable of effective technology absorption, adaptation and development;**
- **Providing technical support to develop and strengthen technical institutions, such as metrology institutes, testing laboratories and certification bodies, to facilitate compliance with international product standards;**
- **Strengthening programmes of technical and financial support to SMEs with a view to facilitating their access to domestic markets, including through integration into global supply chains;**
- **Providing technical assistance to developing countries in streamlining and rationalizing licensing, regulatory, fiscal and other measures related to industry that affect risks to private investment and the costs of doing business;**
- **Encouraging wider adherence by industrial enterprises as well as by corporate and government buyers of industrial products to codes of good practice with respect to CSR;**
- **Supporting the work of the task forces of the Marrakesh Process and efforts to elaborate a 10-year framework of programmes on sustainable consumption and production, in particular the work on building sustainable enterprises.**

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Policy options and possible actions to expedite implementation: air pollution/atmosphere

Report of the Secretary-General

Summary

Most air pollution is a consequence of industrial development, energy production and use, and transportation. Efforts directed at adopting cleaner production processes, cleaner energy technologies and cleaner fuels therefore contribute to improving air quality and protecting the atmosphere. Policy options and possible actions are available for reducing air pollution, both indoor air pollution from traditional biomass fuels which adversely affect the health of women and children in particular and ambient air pollution from all industrial, energy and transport sources. The discussion in the present report concludes with a list of options and actions at the international level that would appear to be particularly effective. International cooperative efforts can help ensure that urgent and effective action is taken on these issues to further implementation and thus effectively contribute to achieving the goals of sustainable development.

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I. Introduction

1. At its fourteenth session, the review session of the second implementation cycle 2006-2007, the Commission on Sustainable Development conducted an evaluation of progress in implementing Agenda 21, the Programme for the Further Implementation of Agenda 21, the decisions taken at the ninth session of the Commission and the Plan of Implementation of the World Summit on Sustainable Development (Johannesburg Plan of Implementation), while focusing on identifying constraints and obstacles in the process of implementation with regard to the current thematic cluster. This cluster covers the issues of energy for sustainable development, industrial development, air pollution/atmosphere and climate change. The report of the Commission on Sustainable Development on its fourteenth session[1] includes the Chairman's summary, which reflects the constraints and obstacles, and possible approaches and best practices for the implementation of those intergovernmental agreements, as well as the way forward identified by the ministers attending the high-level segment.

2. At its fifteenth session, the Commission on Sustainable Development will take policy decisions on practical measures and options to expedite implementation for the selected thematic cluster of issues, taking into account the discussions of the intergovernmental preparatory meeting, reports of the Secretary-General and other relevant inputs. The present report is a contribution to the Commission's discussions on policy options and possible actions to address the constraints and obstacles in the process of implementation identified in the report of the review session with regard to air pollution/atmosphere. The other issues of this thematic cluster and the cross-cutting issues identified at the eleventh session of the Commission are addressed in the relevant reports (E/CN.17/2007/2, 3, 5 and 6). Since the issues are interlinked, references to them are included in the present report.

3. The present report draws on a number of sources, including national reports and case studies submitted by Member States, the outcomes of regional implementation meetings and the contributions of major groups and secretariats of various United Nations convention bodies. As the four issues of this thematic cluster are closely linked, the relevance of the interlinkages for policy options is considered in the report on cross-cutting issues (E/CN.17/2007/6). While the cross-cutting issues identified at the eleventh session are considered throughout the present report, many are addressed in the report on cross-cutting issues.

4. Policy options and possible actions for reducing air pollution exist, in terms of both indoor air pollution from traditional biomass fuels which adversely affect the health of women and children in particular and ambient air pollution from all industrial, energy and transport sources.

II. Indoor air pollution

5. The problem of indoor air pollution in both the rural and urban areas of many countries is being addressed by policies and actions that promote access to cleaner fuels for heating and cooking and that raise awareness of the hazards associated with indoor air pollution. The largest reduction in indoor air pollution can be

[1] *Official Records of the Economic and Social Council, 2006, Supplement No. 9* (E/2006/29).

achieved by switching from such solid fuels as biomass and coal to liquid petroleum gas, biogas or electricity. In many developing countries, the LP Gas Rural Energy Challenge initiative of the United Nations Development Programme is being implemented to expand access to cleaner liquid petroleum gas in rural and peri-urban areas. Since 1992, Nepal has implemented its biogas support programme, which has led to the installation of more than 150,000 biogas plants. Most recently, almost 10,000 of those plants were installed under a clean development mechanism project under the Kyoto Protocol.

6. Where fuel switching is not possible, policies could encourage the dissemination of improved cookstoves, which can reduce pollution and cooking time, while better ventilation can reduce exposure to air pollutants. In particular in rural areas, where liquid fuels are often unaffordable, action to scale up such low-cost interventions could significantly reduce exposure. Education to bring about behavioural change, such as keeping young children away from cooking areas, can also be effective. Improved household energy practices promote education, empower women, preserve the health and lives of children and their mothers and benefit forests and the climate. An initial step in this area could be to better publicize the guidelines of the World Health Organization on air quality in order to raise awareness among policymakers and educators of indoor air pollution as a health issue for women and children.

7. Another source of indoor air pollution is the practice of smoking, which can adversely affect the health of children, especially those prone to asthma. Awareness-raising campaigns can be effective in educating the population about the adverse health impacts of tobacco smoke and in reducing indoor concentrations of it.

8. The Partnership for Clean Indoor Air, launched at the World Summit on Sustainable Development, addresses the social and cultural barriers to adopting improved cooking and heating practices and the development of local markets for improved technology. Such initiatives to make cleaner fuels and cleaner-burning stoves available and affordable to the rural and urban poor could be expanded with national and international support.

III. Ambient air pollution

9. Most ambient air pollution is a consequence of industrial development, energy production and use, and transportation. Efforts directed at adopting cleaner production processes, cleaner energy technologies and cleaner fuels therefore contribute to improving air quality and protecting the atmosphere. Strategies that have been adopted include a number of actions, such as information campaigns, the setting of standards, monitoring, strengthened enforcement and the use of such economic instruments as road pricing, pollution taxes and emissions trading. International programmes could support the initiatives of Governments in awareness-raising, planning, implementing and strengthening capacity for monitoring, enforcement and compliance. The Clean Air Initiative of the World Bank provides many examples of effective regional programmes that deal with the major issues of outdoor urban air pollution.

10. Introducing cleaner fuels is an option adopted by many countries to abate urban air pollution. For example, working with the Partnership for Clean Fuels and Vehicles, established at the World Summit on Sustainable Development, as well as

the Clean Air Initiative for Africa, all the countries of sub-Saharan Africa have succeeded in eliminating lead from gasoline. This achievement has been matched at the regional level only by North America and Western Europe. The Partnership provides not only a vehicle for eliminating lead from gasoline in the remaining areas where it is still in use and for working to lower the sulphur content of gasoline and diesel fuel but also a model for similar initiatives to address other serious air pollutants, in particular in urban areas. The use of lead-free fuel also permits policy options that regulate the introduction and use of catalytic converters, which capture the emissions responsible for smog.

11. As Brazil discovered with its proalcool programme, which was implemented to reduce dependency on fossil fuel imports in the transportation sector, the use of such biofuels as ethanol and biodiesel is also an option worth considering for reducing air pollution. An option at the international level is to provide technical assistance at regional and national levels and support the efforts of non-governmental organizations to more widely publicize issues and provide information concerning cleaner fuels and air pollutants. Another option is to support South-South technical assistance to developing countries that plan to produce and use biofuels, in particular ethanol.

12. Polluting transport emissions can also be reduced by choice of vehicles and mode of transport, which can be promoted through tax incentives, as well as by establishing performance standards. The establishment of standards for vehicle fuel efficiency and for vehicle emissions have been used to reduce the emission of air pollutants from vehicles. The situation in California, United States of America, offers an example of both options, with the former limiting vehicle road certification only to compliant models and the latter also establishing standards for vehicle maintenance. Major legislative initiatives have also been implemented in California to phase in zero-emission vehicles and partial zero-emission vehicles, including hybrid electric vehicles that are now commercially available and in considerable demand elsewhere. Some cities have also encouraged non-motorized transport options by incorporating pedestrian walkways and bicycle lanes into urban designs.

13. In developing countries, transport is generally a major source of urban air pollution. Policy options in these countries, in addition to introducing cleaner fuels and establishing vehicle fuel efficiency and emission standards, include restrictions on the use of certain types of high-emission vehicles, especially those powered by small two-stroke engines, the promotion of mass transit systems, the construction of express highways and the redistribution of traffic flows. An option that has already benefited some large cities in developing countries is the establishment of bus rapid transit systems, which provide high-quality transportation services at a considerably lower cost than such other mass transit alternatives as underground and surface rail systems. Examples of novel policies that reduce air pollution, as well as reduce greenhouse gas emissions and promote energy efficiency, include the adoption of multi-mode public transport in Curitiba, Brazil, and the implementation of integrated transport planning with variable electronic tolls for vehicle access to central areas of Singapore.

14. Investment in the introduction, upgrading and expansion of affordable and efficient public transport systems greatly contributes to the alleviation of problems with urban transportation and associated air pollution. In urban areas, consideration could be given to policies favouring efficient transit systems and other solutions to

encourage a shift from private cars to public transportation. Parking fees, business district tolls, vehicle financing arrangements, insurance schemes and other means to affect the cost per trip of vehicle use could also be deployed to encourage a modal shift to more efficient transport systems. Expanded international assistance could help in the development of energy-efficiency policies in the transport sector, including for the design of such public transport schemes as bus rapid transit systems. The sharing of such techniques and experiences, as well as the strategies that integrate transport, urban and regional settlement planning, could promote policies that would significantly improve air quality in the metropolitan areas of many developing countries.

15. Urban air quality is affected not only by transportation emissions but also by the location of industries in or near urban areas. Policy options include the use of urban planning to locate industrial zones beyond urban areas and route heavy traffic flows so they are at a given distance from residential areas. Urban air-quality control programmes in large cities in developing countries could benefit from cooperation with their counterparts in developed countries, such as those in the Sister City International movement or the International Council for Local Environmental Initiatives, an international clearinghouse on sustainable development and environmental protection policies, programmes and techniques that are implemented at the local level.

16. The Clean Air Initiative addresses air quality in cities by facilitating the sharing of knowledge and experiences through partnerships in selected regions of the world. Such cooperation could be useful, in particular with regard to planning, training, capacity-building and gaining access to monitoring technology. Policy options for dealing with industrial air polluters include the establishment and enforcement of emission regulations, assistance to industries through information campaigns, tax relief for compliant enterprises and reducing or eliminating custom duties on imported technologies for industrial emission controls.

17. Regional cooperation in addressing urban air quality has been hampered by inadequate information exchange on best practices in urban air quality management and the lack of harmonized regional air pollution policies. Initiatives, such as the air pollution in megacities of Asia project, aim to increase the capacity of Governments and city authorities to address urban air pollution issues by developing regional action plans and establishing an urban air pollution network for metropolitan areas in Asia.

18. Among the industrial air pollutants, sulphur dioxide is of particular concern as the major source of acid precipitation. Many developed countries have had notable success in controlling such air pollutants as sulphur dioxide through the use of economic instruments, whether through taxes or tradeable emission permits. In particular, the sulphur dioxide emission trading scheme of the United States of America is generally acknowledged to have been both environmentally effective and cost-effective. This has encouraged the adoption of trading schemes in other contexts, such as the experimentation with sulphur dioxide trading in China by the State Environmental Protection Administration and the European emissions trading scheme for greenhouse gas emissions.

IV. Transboundary air pollution and atmosphere

19. Cooperating within the framework of the Convention on Long-Range Transboundary Air Pollution, countries in North America and Europe have been able to significantly reduce transboundary air pollution. The experience gained in the development of the Convention could be shared with countries in other regions, such as Asia, which are increasingly affected by transboundary air pollutants. In particular, it is important to establish monitoring and enforcement mechanisms to ensure that sources of transboundary air pollution are controlled.

20. While aviation and marine shipping are now recognized as increasingly significant sources of air pollution and greenhouse gas emissions, addressing these sources requires international cooperation. The International Civil Aviation Organization has established engine certification standards, including for the nitrogen oxides that result in air pollution at the ground level. An additional concern is the emission of aircraft exhaust at high altitudes, where it can contribute to modifying the composition of the upper atmosphere and the climate through both greenhouse gas emissions and emissions that affect cloud formation. The Intergovernmental Panel on Climate Change has estimated that operational measures, such as improved air traffic management, could realize reductions in fuel burn of between 8 and 18 per cent.

21. Under an annex to the International Convention for the Prevention of Pollution from Ships, which sets limits on sulphur oxide and nitrogen oxide emissions from ship exhausts, parties may establish sulphur emissions control areas, which require use of low sulphur levels or the installation of abatement technology. Sulphur emissions control areas for the Baltic Sea, the North Sea and the Channel Islands entered into force in 2006. At the same time, the shipping industry is promoting the use of emissions trading to control marine air pollution. Within such frameworks, further action could be taken to effectively and economically reduce emissions from aviation and shipping.

22. The ongoing emission of greenhouse gases is changing the composition of the atmosphere to the point where climate is being affected at the global level. This significant air pollution/atmosphere issue is considered in detail in the separate report on policy options and possible actions with regard to climate change (E/CN.17/2007/5).

23. Restoration of the stratospheric ozone layer depends on the continued reduction of stocks of chlorofluorocarbons and halons. The international instruments for dealing with this issue are the Vienna Convention for the Protection of the Ozone Layer, the Montreal Protocol on Substances that Deplete the Ozone Layer and the amendments to the Protocol. While most countries have ratified the Convention and the Protocol, effort is still needed to complete ratification of all the amendments which extend to the ozone-depleting substances covered by the Protocol. Strengthened international efforts could reduce illegal trade in those substances by those attempting to circumvent the provisions of the Protocol. In addition, increased support for research to develop effective alternatives to methyl bromide could advance the reduction and eventual elimination of the stocks of this stratospheric ozone-depleting substance. Kenya has demonstrated the value of such alternatives in agriculture and horticulture.

24. Countries are sharing information on the state of the atmosphere under the Integrated Global Observing Strategy and the Global Atmosphere Watch Programme of the World Meteorological Organization. Enabling the full and active participation of developing countries in such programmes and similar networks could contribute to their capacities for weather forecasting and air pollution monitoring. Sharing cutting-edge observation and modelling tools could enhance existing initiatives.

V. Policy options and possible actions at the international level

25. **Policy options and possible actions at the international level that could be considered with regard to air pollution/atmosphere concerns include supporting:**

(a) **The Partnership for Clean Fuels and Vehicles in its efforts to complete the global elimination of leaded gasoline and supporting that or other initiatives aimed at reducing the sulphur content of vehicle fuels, as well as the emission of serious air pollutants from other sources;**

(b) **Capacity-building for the development of innovative economic and policy instruments for dealing with air pollution at the local level;**

(c) **Establishment of regional and subregional cooperative agreements to reduce transboundary air pollution involving not only monitoring and abatement but also research and policy formulation;**

(d) **Studies to identify ways to effectively and economically reduce both aviation and shipping emissions and to promote initiatives to establish international agreements on emission limits for exhaust from aircraft and ship engines.**

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Policy options and possible actions to expedite implementation: climate change

Report of the Secretary-General

Summary

The increasingly evident impacts of climate change at various levels lend the issue a particular sense of urgency. International cooperative efforts can help ensure that timely and effective action is taken to mitigate the causes as well as the effects of climate change, to further the implementation of Agenda 21 and the Johannesburg Plan of Implementation and to achieve the goals of sustainable development.

A comprehensive climate change strategy encompassing coherent policies and actions with respect to energy, industry, forestry and waste management could yield multiple benefits for greenhouse gas mitigation and sustainable development objectives. Policy options and possible actions to achieve these objectives could include a combination of improved energy efficiency, increased renewable energy use, better agricultural practices, and sustainable forest and waste management. Such a strategy could include stable incentives and measures to enhance the use of market-based mechanisms, including scaling up the carbon market, and expanding the range of clean development mechanism activities.

Countries vulnerable to the adverse impacts of climate change, especially least developed countries and small island developing States, require increased assistance for the development and implementation of adaptation strategies. This could include improving the dissemination of information, enhancing resilience to the adverse impacts of climate change and climate variability and integrating adaptation measures into national sustainable development strategies and national development planning.

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I. Introduction

1. At its fourteenth session, the review session of the second implementation cycle 2006-2007, the Commission on Sustainable Development undertook an evaluation of progress in implementing Agenda 21, the Programme for the Further Implementation of Agenda 21 and the Plan of Implementation of the World Summit on Sustainable Development (the Johannesburg Plan of Implementation), while focusing on identifying constraints and obstacles in the process of implementation with regard to the current thematic cluster. This cluster covers the issues of energy for sustainable development, industrial development, air pollution/atmosphere and climate change. The report of the review session[1] includes a Chairperson's summary that reflects the constraints, obstacles, possible approaches and best practices for the implementation of these intergovernmental agreements, as well as the way forward identified by the ministers attending the high-level segment.

2. The fifteenth session of the Commission on Sustainable Development will take policy decisions on practical measures and options to expedite implementation for the selected thematic cluster of issues, taking into account the discussions of the intergovernmental preparatory meeting, reports of the Secretary-General and other relevant inputs. The present report is a contribution to the Commission's discussions on policy options and possible actions to address the constraints and obstacles in the process of implementation identified in the report of the review session with regard to climate change. Reports on the other issues of this thematic cluster and on the cross-cutting issues identified at the eleventh session of the Commission are available (see E/CN.17/2007/2-4 and 6) and, since the issues are interlinked, there are references to them in the present report.

3. The present report draws on a number of sources, including national reports and case studies submitted by Member States, the outcomes of regional implementation meetings and contributions from major groups and secretariats of various United Nations convention bodies. As close linkages exist among the four issues of this thematic cluster, the relevance of these interlinkages for policy options is considered in a separate report (see E/CN.17/2007/6). Although cross-cutting issues identified at the eleventh session are considered throughout the report, many are addressed in the present separate report.

II. Climate change: a threat to sustainable development

4. Climate change during this century is likely to entail increased frequency and intensity of extreme weather events, increases in sea level and ocean acidity that will not be reversible for centuries to millennia, large-scale shifts in vegetation with major losses of climate-sensitive plant and animal species and significant shifts in the geographical ranges of disease vectors and pathogens. A recent study[2] has concluded that if greenhouse gases continue to be emitted without abatement, between 5 and 20 per cent of the global gross domestic product (GDP) could be lost by the beginning of the next century. On the other hand, it projects that stabilizing atmospheric concentrations of greenhouse gases at roughly twice pre-industrial levels could cost 1 to 3 per cent of the global GDP. A comparison of these levels of

[1] *Official Records of the Economic and Social Council, 2006, Supplement No. 29* (E/2006/29).

[2] Stern Review on the Economics of Climate Change, November 2006.

spending with the potential costs of greenhouse gases emissions indicates that taking action today aimed at stabilizing the concentrations is a good long-term investment.

5. The United Nations Framework Convention on Climate Change remains the central multilateral framework for cooperative actions to mitigate climate change by reducing greenhouse gas emissions and enhancing their removal by sinks, and to adapt to the adverse impacts of climate change. There is broad agreement that international cooperation and actions at the national level on all aspects of mitigation and adaptation should be promoted. At the eleventh Conference of the Parties to the Convention, the parties launched a dialogue to analyse strategic approaches for long-term cooperative action to address climate change, focusing on sustainable development, adaptation, technology, and market-based opportunities. In a parallel process, the Parties to the Kyoto Protocol of the Convention initiated a process to consider further commitments beyond 2012, when the current commitment period terminates.

6. An integrated approach that considers the social, economic and environmental dimensions and encompasses coherent policies and measures in all the relevant sectors -- including energy, agriculture, water, waste management, industry, transport and coastal zone management — could be conducive to achieving a comprehensive, long-term response to climate change. To this end, there is an opportunity to more firmly link climate change to the broader agenda of sustainable development by integrating climate-change response policies with national development planning, national sustainable development strategies and poverty reduction strategies.

7. A comprehensive climate-change mitigation strategy can yield multiple benefits for sustainable development objectives. For instance, improving energy efficiency not only provides an effective policy option for reducing global greenhouse gas emissions, but also yields such domestic environmental, economic and social co-benefits as reduced local air pollution with associated health benefits, cost savings for energy consumers, and avoiding or postponing the construction of additional generation capacity. When generated using renewable energy, electricity provides numerous economic and social co-benefits — from new income opportunities to improved education, health care and information access — with no greenhouse gas emissions.

8. Sustainable forest management can contribute to terrestrial carbon sequestration and have beneficial effects on water supplies and biodiversity. Policies designed to enhance carbon sequestration through fuelwood management could also improve natural resource management. For instance, a World Bank project in Senegal, based on community management of forest resources, ensured a sustainable fuelwood supply and provided livelihood activities such as honey, livestock, vegetable, tree crop and poultry production. Other components were demand-side management through improved cookstove and fuel substitution. The co-benefits were improved living standards, sustainable forest and rangeland management and carbon sequestration.

9. Climate change will exacerbate water shortage and quality problems in many water-scarce regions. Climate change impacts the frequency and intensity of floods and droughts, and water quality and availability. It will also pose daunting challenges for water management, which is best addressed through integrated water

resources management. Therefore, policy options are needed to enhance adaptive capacities, particularly in vulnerable countries, to minimize those adverse impacts. Policy options that could be considered include: increasing water-use efficiency on the demand side, such as through pricing incentives and regulations; increasing the reliability of the water supply, such as through increasing water storage capacity and constructing water diversion infrastructure; and reformulating flood management plans.

10. Existing technologies could play an important role in improving energy efficiency and reducing greenhouse gas emissions in the short term. Yet policies and actions are also needed that could accelerate improvements in these technologies as well as the development of new technologies required to achieve more substantial greenhouse gas reductions in the long term. Thus, energy technology research and development are key components of long-term mitigation strategies. In many countries, public and private spending on these investments is stagnant or declining. Enhanced public support for, and incentives for private investment in, energy technology research and development could form an important element of an overall strategy to overcome the technical and cost barriers faced in developing promising clean energy technologies. International initiatives for technology cooperation between developed and developing countries could provide developing countries with access to advanced technologies and improve their capacities for using, adapting and further refining these technologies.

11. While many cleaner technologies offer co-benefits that may justify their adoption without reference to climate change concerns, other technologies would require incentives and a supportive policy environment. Policies and actions could accelerate the rate at which new clean technologies are adopted and commercialized. Risks associated with new energy technologies could be addressed through government support for the construction of full-scale demonstration plants, which prove that technologies are viable at scale and under normal operating conditions. Various policies could be used to support the deployment of new technologies that are not yet cost-competitive, but which are expected to be less costly with experience and wider deployment.

12. The carbon market taking shape, first in Europe and then globally as a result of the Kyoto Protocol, is setting a price on "carbon" (i.e., the greenhouse gases covered by the Kyoto Protocol), which provides an incentive to reduce emissions so long as the cost of reduction is below the market price for carbon. Pricing carbon can also be achieved by means of a carbon tax, with the possibility that revenues could be invested in low-carbon technologies. Since it is difficult to predict the price of carbon many years ahead, energy and other enterprises are hesitant to invest in long-lived capital with a lower carbon emissions profile. Progress towards a global regulatory framework with a longer time-horizon and stable incentives could stimulate investment in clean energy technology and remove market uncertainties regarding the credibility of the carbon markets. Meanwhile, recent research suggests that the costs of delay in taking action to reduce greenhouse gas emissions could be much higher than previously thought. Consideration of this possibility has motivated some energy and other enterprises, as well as some Governments, to devote larger resources to research and development into low-carbon energy technologies. Further public support for such research and development could promote public welfare as well as private profits.

13. According to the International Energy Agency, carbon dioxide (CO_2) capture and storage technology could control emissions from fossil-fuel power plants at relatively low cost, but would not be adopted without an incentive, such as a market price for carbon or an explicit subsidy. The use of CO_2 as a resource, such as for enhanced oil recovery, provides an added incentive to capture CO_2. Several enhanced oil recovery projects under development would capture the CO_2 from power plants and pipe it into mature oil fields.

14. A significant percentage of the power plants in developed countries will be replaced in the coming decades, while sharply rising demand for electricity in rapidly industrializing countries is driving the construction of new power plants. This situation presents an important opportunity to ensure that the new power plants either incorporate CO_2-capture systems from the outset or are designed to be retrofitted with such systems. Research is expected to reduce the cost of these systems. This underlines the importance of policies and actions that promote further research on and the rapid deployment and commercialization of CO_2 capture and storage technologies. In this respect, the aim of the Carbon Sequestration Leadership Forum, an international climate change initiative with 21 country members that promotes the development and sharing of technologies for CO_2 capture and sequestration, is to make these technologies broadly available internationally.

15. Energy efficiency improvements could significantly mitigate greenhouse gas emissions, in many cases at lower cost than other available abatement options, but policies and actions are required to overcome information gaps and market, institutional and financial barriers. Policies promoting energy efficiency in stationary infrastructure with long lifespans, such as in new power plants and buildings, could make a significant contribution, in some cases with net savings. Given that the transport sector is the fastest growing source of CO_2 emissions, policies and actions to enhance vehicle efficiency could also be an important part of efforts to reduce CO_2 emissions. Improving vehicle efficiency would also help to address urban air pollution, a major source of which is motor vehicles, and attract consumers faced with higher fuel prices.

16. International cooperation could significantly enhance the effectiveness of policies to promote the development, deployment and diffusion of new and less greenhouse gas-emitting technologies. Such collaboration could avoid duplication of effort and facilitate further improvement through information exchange. For example, Coalfleet for Tomorrow is an industry-led, broad-based collaborative research programme that brings together power producers, equipment suppliers and research partners from five continents with the goal of making available a portfolio of advanced coal technologies. Policies and actions supporting such technology collaboration and deployment could assist in achieving the diffusion of new technologies, as well as engage more countries in the mitigation of greenhouse gas emissions.

17. The establishment of enhanced investment frameworks for clean energy, such as the investment framework for clean energy and development under discussion at the World Bank, could significantly scale up the required investments, particularly if policies can leverage private financing. International support could also facilitate the participation of developing countries, particularly African nations, in carbon

markets through increased capacity-building to enable active participation in the clean development mechanism.

18. Greenhouse gas emissions from aviation and marine bunker fuels are rising rapidly, driven by the growth in air travel and international trade, respectively. Given the lack of substitutes for aviation and marine bunkers, efficiency improvements are the focus in both transport sectors. With respect to aviation, the Intergovernmental Panel on Climate Change (IPCC) has estimated that fuel burn could be reduced by 6 to 18 per cent with better operating measures, particularly air traffic control. The International Civil Aviation Organization (ICAO) reports on its emissions-related activities to the United Nations Framework Convention on Climate Change, in particular initiatives to improve the quality of data reporting and comparability of aviation emissions. Similarly, the International Maritime Organization (IMO) cooperates with IPCC and the Convention bodies on methodological issues. Working within the framework of these organizations, further action could be taken to address greenhouse gas emissions from aviation and shipping.

19. While international cooperation is essential to tackling the global challenge of climate change, it is likely to succeed only if underpinned by national and local initiatives. In many countries, Governments, local authorities, private companies, educational and other institutions and other stakeholders are adopting a broad range of measures to reduce their greenhouse gas emissions. In some countries, policy innovation is occurring at the provincial/state and local levels. Numerous public and private sector institutions and organizations have adopted policies that commit them to offsetting their greenhouse gas emissions through the purchase of carbon credits from such sources as low-carbon energy projects, reforestation and sustainable forest management programmes.

III. Adapting to climate change

20. According to IPCC, the available evidence indicates with a high degree of confidence that recent changes in average global temperature have had discernible impacts on many physical and biological systems and on biological diversity and desertification. The impacts of accelerating climate change and intensifying climate variability also pose a threat to economic and social systems, for instance in the case of more frequent and extensive droughts and floods. While current information already warrants urgent action, there is a need for more analysis to improve the understanding of the impacts of climate change and climate variability on economic and social development. Such research and the evaluation of ongoing projects, while necessary to improve the understanding of which adaptation measures are most effective, should not detract from the need to begin taking action now. Measures which enhance capacities to forecast and plan for adaptation to climate change are, therefore, urgently needed, particularly in developing countries, to reduce vulnerability to climate change impacts, including extreme weather events.

21. Adaptation is a multi-faceted challenge and, to be effective, strategies to adapt need to proceed at several levels simultaneously. The direct impacts of climate change are felt locally and more broadly and, therefore, responses must address these circumstances. At the same time, for such efforts to be sustainable and, in

some cases, possible, they need to be guided and supported by national policies and strategies. These, in turn, may be facilitated through international efforts.

22. Options that enhance capacities for nations and societies to adapt to climate change include a broad range of options, from specific measures and actions to adjust to new climate risks at the sectoral and community level, to a comprehensive set of policies and measures that generally enhance the capacity to adapt, which is in large measure a function of a society's level of wealth, education and access to technology. Moreover, these options can be part of general national development strategies. At the community and national levels, one practical option to reduce vulnerability and facilitate preventive steps could be effectively disseminating information on additional climate risks and extreme events to decision makers and affected populations. For vulnerable developing countries, this could be facilitated by international support from the donor community and multilateral organizations, including through identifying and supporting low-cost or negative-cost adaptation measures and technologies in least developed countries and small island developing States.

23. Support for actions to enhance research, observation and early warning capacities for adaptation to climate change, particularly in developing countries, could contribute to lowering existing uncertainties relating to the timing and scale of impacts, especially at the regional level. One practical option could be to strengthen the national capacity for data collection and early warning in developing countries. Seasonal forecasting is one adaptation strategy for farmers, who could act on the information by adjusting planting schedules or crop/cultivar choices. Early warning, including effectively disseminating this information to decision makers and affected populations, could facilitate preventive steps. Such measures could be incorporated in comprehensive national adaptation strategies.

24. Research in the water sector indicates that climate change may decrease water availability in some areas and increase it in others. In this context, specific measures include the design and construction of infrastructure for water management which benefit from taking these research results into account within an overall policy of integrated water resource management. Such an approach could be enhanced by strengthening the role of local authorities in the planning process. Since many countries possess limited capacity to implement integrated water resource management, international support for introducing good water management practices and building the capacity of the relevant institutions are necessary and could also contribute to meeting the Millennium Development Goals and alleviating poverty.

25. Regarding agriculture, in areas where the climate change impact on agriculture are likely to be negative, basic adaptation measures, such as altering planting dates and cultivar choices, could be taken. More intensive, and expensive, adaptation options could include the introduction of irrigation systems. In areas prone to drought, farmers could benefit from the introduction of drought-resistant crops. Adaptation measures that strengthen and improve land management practices could improve resiliency to these impacts. In addition, since cultivation practices and land-use change can affect sources of greenhouse gas emissions, environmentally sound cultivation methods and better land-use planning could contribute to reducing CO_2 emissions.

26. Concerning human health, IPCC concludes that while some effects may be positive, most of the diverse potential health impacts from climate change are likely to be negative. The risk posed by extreme weather events such as heat waves could be mitigated through increased public awareness and public health-care initiatives for the most vulnerable. The geographic range of some vector-borne infectious diseases, such as malaria, could expand with an increase in temperature and conducive rainfall patterns. The possible impact of climate change on health in all countries provides an additional reason for investing in medical research on vector-borne diseases and for strengthening and maintaining public health systems, particularly in developing countries.

27. Research shows that weather-related losses have been rising steadily over the past half century, with part of the increase due to socio-economic factors, such as increased wealth and urbanization in vulnerable areas, and part linked to climatic factors such as changes in precipitation, flooding and droughts. Whether or not such losses can be attributed to climate change, the risk posed by weather-related disasters could be partially mitigated by insurance schemes and enhanced public awareness and dissemination of information concerning risks. At the same time, owners of property in certain vulnerable coastal areas have experienced a sharp rise in premiums or are no longer able to obtain coverage from private insurers. Practical measures, such as appropriate zoning and building codes, can reduce risks. For instance, in the United States of America, the insurer-funded Institute for Business and Home Safety supports a programme to improve the disaster resilience of homes and businesses, which has demonstrated significant loss avoidance for low investment.

28. As shown at the national and community levels in recent studies and assessments, including those under the National Adaptation Programmes of Action process of the United Nations Framework Convention on Climate Change and the Assessments of Impact and Adaptations to Climate Change project, policies and investments that enhance the capacity of communities to adapt to climate change could, if properly designed, improve economic opportunities and livelihoods. Actions that alleviate poverty and hunger, empower women and improve access to basic services, such as potable water and education, would reduce the overall vulnerability of communities to the impacts of climate change. Thus, improving livelihoods can enhance resilience and capacity to cope with climate variability. Particularly where communities are already vulnerable due to climate variability or environmental change, actions that strengthen adaptive capacity can serve a dual purpose. For instance, in arid and drought-prone areas, adaptation concerns may be an additional reason to implement possible actions such as water conservation. Similarly, rainwater harvesting is a possible action for small island developing States faced with groundwater salination as a result of saltwater intrusion or water scarcity resulting from variable rainfall patterns.

29. At the institutional level, potential responsibility for adaptation measures is often spread across levels of Government and spans sectors such as agriculture, water, coastal zone management, and disaster preparedness. At the same time, adaptation may not be considered a core function of any of the affected sectoral government bodies and agencies. Based on national policy, as set out in their national sustainable development strategy or other similar document, one policy option is to integrate adaptation planning into the work of affected agencies, as well as inter-agency bodies covering sectors such as health, economic policy and natural

resources. Adaptation strategies and plans could be enhanced on the basis of lessons learned and expertise developed in the area of disaster risk reduction and management, including effective early warning, land-use planning, construction standards and risk assessment in development projects.

30. At the international level, there are several channels providing technical assistance to developing countries that could be further strengthened to enhance adaptive capacities and to implement actual adaptation measures. Under the United Nations Framework Convention on Climate Change, international mechanisms to support adaptation measures include three new funds and associated processes: the Special Climate Change Fund, which includes support for the implementation of adaptation activities where sufficient information is available; the Least Developed Countries Fund, which includes support for the preparation and implementation of National Adaptation Programmes of Action; and the Adaptation Fund, under the Kyoto Protocol. Progress was made on the establishment of the Adaptation Fund at the twelfth Conference of Parties to the Convention by defining the principles and modalities governing the administration of the Fund. It is expected that programme priorities and eligibility criteria for the activities to be supported by the Adaptation Fund will be determined at the thirteenth Conference of Parties. The Global Environment Facility has introduced its strategic priority, piloting an operational approach to adaptation, which aims to reduce vulnerability and to increase adaptive capacity to the adverse effects of climate change in the focal areas of the Facility. To date, international efforts on adaptation under the Convention have focused on delivering information, some resources and capacity-building, especially in relation to the assessment of impacts and adaptation. In most cases, it has yet to facilitate significant on-the-ground implementation, technology development and diffusion, or the establishment of robust national institutions to implement an adaptation agenda.

31. Another broad approach to adaptation is to work through existing channels of multilateral and bilateral assistance to promote the integration of adaptation needs into development support. At a meeting in April 2006, the ministers of environment and development cooperation of the member countries of the Organization for Economic Cooperation and Development (OECD) adopted a declaration on integrating climate change adaptation into development cooperation. Vulnerability assessments for projects financed through development assistance can be an effective means of identifying investments that would increase climate resilience. The World Bank estimates that 20 to 40 per cent of official development assistance and concessional finance ($20 to 40 billion) may be subject to climate risk.

IV. Policy options and possible actions at the international level

32. The international effort to respond to the climate challenge will arise not from a single solution, but from a broad array of measures and strategies, which could be pursued simultaneously.

33. **Policy options and possible actions at the international level that could be considered with regard to climate change and sustainable development include:**

- **Enhancing access to cleaner energy technologies, including renewable energy, energy efficiency and advanced fossil-fuel technologies such as**

CO_2 capture and storage technologies, through promoting cooperation initiatives and partnerships at the regional and international levels; and

- Continue efforts to elaborate a framework with stable incentives and a long-term time horizon, among other things, by enhancing the use of market-based mechanisms, including in particular scaling up the carbon market, and expanding the range of clean development mechanism activities;

- Enhancing cooperation for developing and implementing adaptation programmes by involving a broad range of stakeholders and communities that could help all, but particularly developing, countries in assessing and planning for adaptation and reducing vulnerability to climate risks, and in taking informed decisions at all levels;

- Supporting vulnerable countries, especially least developed countries and small island developing States in the development of comprehensive national adaptation strategies for climate change and climate variability, including improving the dissemination of information relating to climate change-related risks at all levels of policymaking and integrating these strategies into national sustainable development strategies and national development planning;

- Providing assistance to vulnerable countries, especially least developed countries and small island developing States, to implement high-priority measures in national strategies, including for identifying and supporting low-cost or negative-cost adaptation measures and technologies;

- Providing technical assistance to strengthen the data collection, observation and research and assessment capabilities of developing countries in order to enhance their early warning and seasonal forecasting capacities, improve the dissemination of information relating to droughts, floods and extreme weather events, strengthen surveillance, control and treatment of vector-borne diseases and improve capacity for regional-level impact assessment and modelling;

- Support efforts to raise the awareness and the profile of climate change within government, including through the greater involvement of economic, finance and planning ministries and agencies.

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Policy options and possible actions to expedite implementation: inter-linkages and cross-cutting issues

Report of the Secretary-General

Summary

Strong inter-linkages among the four issues in the thematic cluster exist so that policies and measures aimed at one issue may have co-benefits for other issues. Providing access to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services may advance industrial development, reduce air pollution and lower greenhouse gas emissions. Such inter-linkages are highlighted in the present report with a view towards developing a menu of policy options and measures of optimal effectiveness. The interlinked aspects of those issues are also reflected in the separate thematic reports where appropriate. International cooperative efforts can help to ensure that urgent and effective action is taken that build on the inter-linkages among those issues to further implementation and thus effectively contribute to achieving the goals of sustainable development.

Furthermore, most of the cross-cutting issues identified at the eleventh session of the Commission on Sustainable Development, including those related to the means of implementation, are relevant within the context of the thematic cluster of issues under consideration. Policy options and measures to further sustainable development goals with respect to the cross-cutting issues and energy for sustainable development, industrial development, air pollution/atmosphere and climate change are identified.

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I. Introduction

1. At its fourteenth session, the review session of the second implementation cycle 2006-2007, the Commission on Sustainable Development undertook an evaluation of progress in implementing Agenda 21, the Programme for the Further Implementation of Agenda 21, the decisions taken at the sixth session of the Commission (dealing with industry and sustainable development) and at its ninth session (dealing with energy for sustainable development and protection of the atmosphere), and the Plan of Implementation of the World Summit on Sustainable Development (Johannesburg Plan of Implementation), while focusing on identifying constraints and obstacles in the process of implementation with regard to the current thematic cluster. This cluster covers the issues of energy for sustainable development, industrial development, air pollution/atmosphere and climate change. The report of the review session (see E/2006/29) includes a chairperson's summary that reflects the constraints and obstacles, and possible approaches and best practices for the implementation of those intergovernmental agreements, as well as the way forward identified by the Ministers attending the high-level segment.

2. The present report is a contribution to the Commission's consideration of policy options and possible actions to address the constraints and obstacles to implementation identified in the report of the review session. The fifteenth session of the Commission on Sustainable Development will take policy decisions on practical measures and options to expedite implementation for the selected thematic cluster of issues, taking account of the discussions of the intergovernmental preparatory meeting, reports of the Secretary-General and other relevant inputs.

3. The present report draws on a number of sources, including national reports and case studies submitted by Member States, the outcomes of regional implementation meetings, and contributions from UN-Energy, major groups and secretariats of various United Nations conventions. As close linkages exist among the four issues of this thematic cluster, the relevance of those inter-linkages for policy options is considered in a separate section. Cross-cutting issues identified at the eleventh session of the Commission are considered in the present report as well as in the four thematic reports prepared for the current session (E/CN.17/2007/2-5).

4. A menu of policy options and measures for implementation at the regional level are included in separate annexes to the present report that reflect the unique characteristics and needs of each region. The annexes were prepared by the respective United Nations regional commissions ECA, ECE, ECLAC, ESCAP, ESCWA, annexes I-V, respectively.

II. Inter-linkages among issues

5. Policy options and possible actions can be more effective if their interlinked aspects are taken into consideration at the outset. Many policies and actions can have multiple benefits. Policies to enhance energy efficiency are likely to have positive impacts on industrial development, air pollution/atmosphere and climate change. Capacity-building projects, such as those aimed at improving information technology capacities, may have impacts on a wide range of areas, including the delivery of sustainable energy services, industrial development and institutional

development. A well-designed forest management policy can contribute to mitigating climate change by sequestering carbon in the trees and soil while providing local communities with livelihoods. Health benefits can also accrue from using energy more efficiently. Other notable examples include actions for improving energy access in rural areas that open opportunities for small-scale industry development and thereby for income generation, including for women. Utilizing modern energy services reduces indoor air pollution, thus improving prospects for better health among women and children.

6. Some policy options and actions require an integrated approach to be effective. Thus, actions taken to transfer energy-efficiency technology and the associated know-how to developing countries often require complementary financing arrangements to enable entrepreneurs to make the necessary investment in such technologies. Similarly, policies to disseminate improved, drought-resistant crops in areas subjected to changing climate may not be effective without appropriate agricultural extension services or financial arrangements for those who are unable to buy the necessary inputs. An integrated process of decision-making that takes such factors into account at an early stage has been proven to enhance policy effectiveness. Although an integrated approach may add to the complexity of decision-making, it can help to ensure that better decisions are made.

7. A holistic approach using national sustainable development strategies and other national sustainable development plans can yield better results by addressing the inter-linkages among the issues, especially when considering policy options, undertaking actions and implementing on-the-ground projects. In assessing energy policy impact and effectiveness, it has become clear that countries that have incorporated energy considerations into national planning, including some countries of South America, have been able to achieve co-benefits, such as enhanced employment opportunities. National plans can highlight rural-urban interfaces that are important for the successful implementation of energy and industrial development policy options and possible actions, and can bring about improvements with regard to air pollution/atmosphere and climate change as well as socio-economic development.

8. Options for strengthening national development plans include highlighting the importance of, and including energy aspects in national sustainable development strategies and other national development plans, an often overlooked area. Utilizing analytical tools that enhance development plan formulation can lead to better decision-making. Energy indicators for sustainable development, which are flexible tools designed for use at the national level, could be used to assess potential impacts of various policy options on sustainable development for the medium and long term.

9. Inter-linkages with the issues of other thematic clusters are also important. Water provides an important link not only to energy and industrial development, but also to agriculture. Integrated water resources management is a planning and implementation process that encourages a community-participation approach for pursuing forward-looking management and development of water resources. It can be applied as a framework within which to assess and allocate competing water uses, for example for hydropower generation, power plant cooling, and agricultural, industrial and domestic uses. Given these important intersectoral inter-linkages, more effort could be given to assisting developing countries with the preparation of integrated water resources management plans, in accordance with the Johannesburg

Plan of Implementation. Policies for promoting freshwater extraction, collection and distribution using renewable sources of energy have proven to be particularly effective in addressing freshwater constraints of small island developing States.

10. Climate change impacts can pose a threat to prosperity and security through large-scale social and economic disruptions. Major shifts in rainfall patterns could lead to reduced agricultural productivity and hence reduced food security and increased poverty, particularly in least developed countries. Also, sea-level rise could lead to the inundation of many low-lying countries and regions, especially the small island developing States. Other impacts include increased water shortages and decreased water quality, and more frequent droughts and floods, as well as the spreading of infectious diseases. All those impacts could threaten the physical security of human settlements and economic infrastructure, as well as human health systems. Potential consequences include migrations from the affected regions to other parts of the world and exacerbation of conflicts over resources at various levels. Therefore, protecting the climate system is a prerequisite for economic prosperity and sustainable development at all levels.

11. Policy options and possible actions directed towards promoting regional and interregional cooperation can be enhanced by greater focus on the inter-linkages among the four issues of the thematic cluster. Among the range of issues in development planning, regional plans for some subregions of Africa have sought to facilitate the efficient use of shared resources, including hydropower, natural gas and the interconnection of national power grids to achieve specific goals of improving access to energy, alleviating poverty, promoting industrial development and reducing air pollution. Taking action to promote regional and international cooperation on improving energy infrastructure can also help to allay energy security concerns.

III. Cross-cutting issues

12. Some of the cross-cutting issues identified at the eleventh session of the Commission on Sustainable Development are particularly relevant to the cluster of themes under consideration. They are considered here and in the thematic reports (E/CN.17/2007/2-5) as appropriate. Owing to the strong inter-linkage, the cross-cutting issues of changing unsustainable consumption and production patterns and sustainable development in a globalized world are covered in the thematic report on industrial development (E/CN.17/2007/3).

13. Many of the policies identified in this cluster and which are intended to improve access to modern energy services, such as cooking and heating fuel for the poor, which also curb indoor air pollution, would be of particular benefit to women who, with children, are most likely to suffer its effects. In choosing from a menu of options, policies could be designed to ensure optimal co-benefits, including more time for child-rearing, increased economic opportunities, and better access to health services and education. The highlights the importance of integrating the concerns of women and children into overall energy planning and of linking access to energy for women with income generation and enterprise development opportunities.

14. Despite ample energy resources, access to energy in sub-Saharan Africa remains very low and supplies of electricity are confined to urban centres, sometimes with poor quality. The geographical distribution of energy resources such

as hydropower, as well as small national energy markets, means that Africa could benefit from policies to promote the development of cross-border infrastructure for energy trade, as noted in the thematic report on energy for sustainable development (E/CN.17/2007/2). Strengthening such infrastructure could be carried out in the context of deepening regional integration, which remains a priority for the region as a whole. Although African economies have benefited from an economic upturn, partly as a consequence of the rise in commodity prices, there is a need to implement policies promoting diversification, in particular by creating an enabling environment for industrial development. At the international level, initiatives for enhanced market access for African countries could spur industrial development, in combination with appropriate national policies, as advocated in the New Partnership for Africa's Development (NEPAD). While Africa is responsible for only a small fraction of total global greenhouse gas emissions, a combination of geography and socio-economic development means that the continent exhibits a high degree of vulnerability to the adverse impacts of climate change and climate variability.

15. Policies and measures on the thematic cluster of issues under consideration have potential to contribute significantly to achieving sustainable development goals in small island developing States and least developed countries. Encouraging the production of renewable energy from sugarcane, coconuts and other biomass, can potentially have a positive impact on rural development and energy security in some small island developing States and least developed countries. The use of renewable energy, such as biofuels and solar energy, on remote islands and rural areas lacking electricity can facilitate the development of micro-industries and small business opportunities. Policies and measures to promote renewable energy for small and medium-size enterprises and to encourage local industry in small island developing States to increase renewable energy use include fiscal and economic incentives for users of renewable energy, import tax and duty concessions, incentives to support the use of cleaner-burning biofuels and the development of alternative cooling methods for the tourism sector, and the establishment of "internal catalysts" in the form of local agencies to promote renewable energy development. As noted in the report on energy for sustainable development (E/CN.17/2007/2), public-private partnerships are another way to encourage technology transfer and the investment of private funds and expertise in small island developing States and least developed countries. In many small island developing States there is potential to expand linkages between tourism and agriculture and appropriate policies and measures include promoting the use of locally produced food in the hotels and increased regional cooperation and centres of excellence for knowledge-sharing, joint research and data collection.

16. Policy options and actions to address public health concerns, if taken in the broad framework of sustainable development, can support adaptation to health impacts of climate change. Measures taken to strengthen primary health-care systems, such as public health monitoring, disease surveillance and control programme, disaster preparedness, and others can help to improve emergency response to victims of heat waves and other severe weather events associated with climate change, as well as to increased incidences of infectious diseases as a result of intensified rainfall and flooding in warmer regions.

17. As a cross-cutting issue, the contribution of education to achieving the goals of sustainable development can hardly be overemphasized. Moreover, science and technology education, and research and development capabilities can strengthen

capacities to undertake work on each of the four issues. The importance of education is emphasized by the United Nations Decade for Education for Sustainable Development 2005-2014, which is led by the United Nations Educational, Scientific and Cultural Organization. It has elaborated a framework that could benefit from further international support. As an element of an integrated national sustainable development strategy, some Governments have provided an enabling environment for the establishment of science and technology parks open to joint ventures and foreign investment. Parks, such as those established in Brazil, China, India and Qatar, could bring scientific research and development strengths together with industrial and entrepreneurial expertise in support of the issues of this thematic cluster.

IV. Means of implementation

18. An adequate and predictable flow of financial resources is a key requirement for implementing the intergovernmental agreements related to the four issues of this thematic cluster. Responsibility for decision-making, implementing and funding policy options and actions lie in the first instance with national Governments, with local governments also playing an important role — depending on the degree of centralization — in providing infrastructure and services. Policy approaches for meeting financing needs in this thematic cluster vary depending on the particular challenges and constraints to be addressed. Nevertheless, bilateral support provided through official development assistance (ODA) and multilateral support from the Global Environment Facility (GEF) and international financial institutions (IFIs) will continue to be important financing sources for many developing countries, especially for infrastructure projects where large-scale investments with long payback periods are required.

19. Although a number of countries have benefited from debt reduction or cancellation, the magnitude of the challenges, particularly with respect to energy access, underlines the need for continued and increased support, including ODA. International support could contribute significantly to public infrastructure projects in developing countries, which is likely to be crucial in certain areas particularly in guaranteeing access to energy services for the poor, at times supplementing private investment. This could include public-private partnerships and mechanisms to cover certain types of risk, such as country risk or regulatory risk. Various studies indicate that major investment in energy infrastructure will be required to provide access to modern energy services for those currently relying on traditional fuels. Regions having difficulty attracting private sector external financing could be considered for ODA on an expedited basis, especially sub-Saharan Africa. International assistance to promote capacity-building related to financing, such as how to develop bankable proposals, leverage existing funds and develop and utilize financial instruments, could promote implementation. At the regional level, in cooperation with the IFIs, and, in particular, with the regional development banks, countries could strengthen efforts to pool resources for the financing of projects with specific regional benefits such as in East Africa, which is currently embarking on the regional interconnection of national power grids, as well as in Central and South America.

20. The IFIs, in general, could play a more active role in supporting domestic and regional finance markets and in strengthening financing facilities for investment in energy and industrial projects. The IFIs, as well as bilateral development

cooperation agencies, could focus on mitigating perceived investor risk, especially in countries which have been overlooked by the private sector in the past. Insurance schemes for political risk are one option which can be effective in facilitating foreign direct investment. Among the options to reduce borrowing costs in high-risk environments are co-financing arrangements and revolving funds which permit a blending of finance from domestic financial institutions, bilateral donors and from international or regional development banks. In this way, the international financial institutions with access to concessional funds could enable domestic institutions to improve the terms and lower the costs of their loans.

21. The flow of funds into "emerging markets" from institutional and other portfolio investors seeking high returns has increased in recent years. Portfolio equity flows have grown rapidly with such investments mostly focused on opportunities generated by utility privatization or deregulation of sectors like telecommunications. Net debt flows associated with medium- and long-term bond issues to private creditors have also grown and, in 2005, were roughly equal to portfolio equity flows. Some private investment funds specifically offer long-term debt finance on commercial terms to infrastructure development as, for example, in the emerging markets of Africa. Institutional investors have also participated in international financial institution-led loan syndications in developing countries spanning a broad range of sectors, including extractive industries like oil and gas, infrastructure like power and telecommunication facilities, and both heavy and light industries. Such teaming between the IFIs and institutional investors leverages the funds of the former while reducing risks to the latter. Another leveraging option could be the issuance of "global development bonds", which use tax credits, partial guarantees/insurance, and/or matching funds as donor government enhancements to leverage private capital for "clean energy and sustainable development" investments in developing countries.

22. Tapping domestic capital markets could also be an option for a small but growing number of developing countries. Policy options and possible actions to strengthen the capacity of Governments, local authorities and enterprises to raise capital domestically include such reforms as the establishment of a legal framework for securities issuance and trading, the promotion of local credit-rating agencies and utilizing national development banks where feasible. Domestic capital markets play a growing role in financing industrial development and energy investments in a number of developing countries. Local currency bond markets are now the fastest growing category of emerging market debt. In the case of energy infrastructure, for local authorities and utilities that have difficulty raising financing individually, bond pools or bond banks could offer the opportunity to spread risks across a heterogeneous group of municipalities or other subnational entities. For a large number of developing countries, a priority policy concern is to strengthen domestic financial institutions so that they can act effectively as intermediaries for international financial inflows. In particular, policies and practical measures could encourage domestic banking institutions to extend longer-term finance for large-scale infrastructure projects. Those institutions would also benefit from a strengthening of their capacities to evaluate investment proposals, manage risk and allocate investment capital efficiently.

23. For many low-income developing countries, strengthening measures to increase private investment, including FDI, in their productive sectors remains a high priority. Improving the investment environment and regulatory frameworks

could assist in attracting private sector investments for industrial development, as well as in the provision of energy services. One practical action to enhance FDI could be to support capacity-building efforts of developing countries and countries with economies in transition in their efforts to strengthen their national policy framework for attracting FDI, such as through the Investment Climate Facility for Africa. Complementary investments in physical infrastructure and human capital are usually important for attracting FDI, especially as production becomes more knowledge- and technology-intensive. Recent evidence suggests that joint ventures undertake larger investments in research and development and technology upgrading than do wholly foreign-owned subsidiaries. Governments may wish to consider encouraging such ventures.

24. Supportive policies could encourage local private sector and community provision of energy services to small, remote communities where grid extension would be very costly. One form of government programme that has been successful at minimal cost involves providing loan guarantees for entrepreneurs investing in small-scale, decentralized infrastructure and services like mini-grids based, for example, on renewable energy sources. Such programmes have been coupled with training to improve the ability of entrepreneurs to articulate business plans for loan applications. The IFIs could also assist in meeting the relatively small-scale borrowing requirements of stand-alone and mini-grid energy suppliers, for example, by establishing energy financing facilities which operate similarly to lines of credit, so as to streamline administrative procedures and contain overhead costs for small-scale loans.

25. Micro-finance institutions (MFIs) can be effective in reaching small-scale entrepreneurs, particularly the poor without access to commercial credit, especially poor women. Such financing could be used to expand the decentralized provision of access to energy services and to facilities for small-scale handicraft and manufacturing activities in poor communities. Evidence suggests that micro-finance schemes are even more effective when combined with business skills training for entrepreneur-borrowers. Such training can also contribute to higher rates of loan repayment, thereby enhancing the financial sustainability of MFIs. Many MFIs continue to rely on grants and subsidized credit from international donors, which are of limited size and not highly predictable beyond the short term. Among the options for achieving greater financial stability are administrative cost containment, charging higher interest rates on loans with the risk of losing some of the poorer borrowers, and obtaining access to commercial financing on favourable terms.

26. Closer integration of micro-finance with domestic financial markets could facilitate funding the growth of loan portfolios by drawing on the mainstream financial sector, where adequately developed. Institutions with a strong focus on lending to the poor and a high positive social impact could benefit from government and international support in securing predictable long-term financing. The role of IFIs in providing access to international financial markets on favourable terms could be strengthened.

27. New international investment frameworks and instruments could make a valuable contribution to meeting investment needs for providing access to cleaner energy services for the poor in developing countries. Finalization of the World Bank's investment framework for clean energy and sustainable development has the potential to contribute importantly to implementation efforts. The streamlining of

procedures for existing financing mechanisms like the GEF and the Clean Development Mechanism of the Kyoto Protocol are also areas for possible action.

28. International trade is expanding and would have even greater potential if the Doha Development Round were to reach a successful conclusion with an agreement that addresses key market-access concerns of developing countries. Regardless of the outcome, there will be an ongoing need for international technical support to developing countries, especially the least developed countries and countries in Africa, to strengthen trade infrastructure and institutions, simplify regulations and procedures governing trade, and enhance capacity to diversify and add value to exports. Further international support could be considered for the World Trade Organization's Integrated Framework for Trade-Related Technical Assistance and its Trust Fund, an important aid-for-trade programme that assists least developed countries in developing their trade capacity.

29. Technology transfer is important for realizing progress on all four issues of this thematic cluster. It includes the transfer of technological systems and equipment, as well as the transfer and absorption of the know-how to operate, maintain and adapt energy and industrial technologies to local circumstances. Technology transfer could be promoted through increased technical assistance by developed countries and international organizations, including through support for joint research and development. Given the strength of the private sector's technical know-how, initiatives for technology transfer and diffusion could benefit from public-private partnerships. These partnerships hold potential for facilitating such transfer and diffusion where intellectual property rights are concerned. Transfer of technology and know-how could also be facilitated by encouraging FDI, particularly where broader linkages can be established, such as through joint ventures and strengthening of local supply chains. The effectiveness of such programmes could be enhanced by incorporating capacity-building and training components.

30. Making real progress in the areas covered by the four issues of this thematic cluster require augmented and focused capacity-building at the local, national and regional levels. The development and implementation of appropriate policies to address complex issues, such as adaptation to climate change or promoting industrial development in the context of global competition, pose severe challenges for developing countries. Increasing access to modern energy services would require strengthening the technical and managerial capacity of government agencies and public utilities in many countries. Capacity-building programmes could be built into projects whether funded by government, bilateral ODA, IFIs or the private sector. Targeted capacity-building programmes could be implemented, in coordination with local and national institutions, in individual research institutions, universities and vocational schools. Regional projects, such as the interconnection of national power grids, can provide the motivation for strengthening relevant national institutions through capacity-building. Strengthening South-South cooperation for building capacities is a potentially effective option for sharing information, knowledge and technical know-how. Capacity-building could also be facilitated by modern web-based electronic communications and improved access to libraries and electronic knowledge banks, as well as online networks and links to professional associations and experts.

31. Governments are important consumers of energy services. Governments also have a large role in state-owned energy enterprises in many developing countries.

Thus, sustainable procurement programmes are an option by which Governments can use their financial power to advance goals of sustainable consumption and production, for example, through the purchase of equipment meeting certain energy efficiency standards or of electricity with a certain portion produced from renewable sources.

V. Policy options and actions at the international level

32. Options that could be considered at the international level include:

A. Inter-linkages among issues

- Supporting developing countries in the formulation of national sustainable development strategies that address energy, industrial development, climate change and air pollution/atmosphere issues in an integrated and coherent manner
- Supporting capacity-building processes that lead to the formulation of policy decisions and actions that emphasize the integration of all four issues and that identify and optimize co-benefits.

B. Cross-cutting issues

- Supporting budgeting processes that identify gender impacts and utilize needs assessment tools
- Training for women to become energy technicians and producers of simple energy technologies to improve their ability to contribute to energy-access solutions
- Support to industry associations with outreach to women entrepreneurs
- Support to initiatives to enhance market access for African countries
- Continued support for NEPAD
- Technical support, capacity-building and financing for expanding ethanol production, and bagasse-based electricity generation in small island developing States and least developed countries
- Support for income generation activities aimed at the poor, including in least developed countries
- Capacity-building and support for diversification and specific export promotion measures to reduce poverty
- Capacity-building aimed at skills development for small and medium-size enterprise entrepreneurs in least developed countries and small island developing States
- Capacity-building aimed at strengthening primary health-care systems, such as public health monitoring, disease surveillance and control, and disaster preparedness.

C. Means of implementation

- Technical assistance to strengthen domestic credit and capital markets in developing countries, and capacity-building to strengthen technical, administrative and financial skills to maximize access to capital
- Capacity-building for an integrated approach to decision-making which enhances cooperation and coordination among relevant ministries with a view to better channelling domestic resources to activities aimed at implementing sustainable development programmes
- Strengthened roles for IFIs in investment related to infrastructure for energy and industry, including through innovative approaches to better manage risks, lower capital costs and improve loan terms
- Other financing initiatives, including more effective use of ODA, such as the investment framework for clean energy and development currently under consideration by the World Bank, and in particular facilitating the participation of developing countries in such initiatives
- The development of micro-financing mechanisms suited to the demands of small-scale service providers and enterprises, whether public utilities, community-based cooperatives or private enterprises
- Encouraging developing countries in streamlining investment frameworks to reduce transaction costs to enterprises and to attract greater FDI inflows
- Aid-for-trade initiatives to build the capacity of low-income developing countries to respond to new market opportunities
- Joint research and development programmes, technical assistance and other means of transferring advanced and cleaner technologies to developing countries, such as public-private partnerships and joint ventures
- Supporting developing countries in their efforts to establish science and technology parks for new and emerging technologies for sustainable development.

Annex I

Contribution from the African region*

The following range of policy options and actions and practical measures are drawn from the Africa review reports on the various themes and results of the Africa Regional Implementation Meeting (RIM).

Energy for sustainable development

A. Feasible, workable and acceptable policy options identified

- Develop environmentally and socially balanced hydropower projects in Africa to take advantage of the largely untapped hydropower potential of the region within the framework of the NEPAD Energy Action Plan on the development of large hydropower plants
- Promote energy diversification as a means to achieve energy security, by removing barriers for an optimal exploitation of all energy resources, including the development of environmentally and socially balanced hydropower projects in Africa
- Integrate into and implement as part of poverty reduction strategy papers and national sustainable development strategies urgent measures to scale up access to modern energy, with special attention to rural and peri-urban areas in order to achieve the internationally agreed development goals including those contained in the Millennium Declaration
- Design and implement urgent measures to modernize and assure energy efficiency of the traditional biomass energy sector so as to reduce the negative impact of its heavy usage on human health, the environment and on other issues related to the Millennium Development Goals, and ensure its overall sustainability

B. Actions and practical measures recommended and undertaken

- Enhance national capabilities of forestry services and energy agencies for wood energy planning and development to promote adequate and affordable sustainable energy services
- Develop and promote off-grid systems based on renewable energy in rural areas to increase energy access
- Increase subregional energy trade by the establishment of power pool arrangements in each subregion, and the signing of agreements for cross-border electricity, oil and gas exchange
- Scale up efforts in support of consensual African regional energy-related initiatives such as the NEPAD and the African Energy Commission energy action plans, take measures to increase the financial flow in the energy sector

* Submitted by the Economic Commission for Africa.

and strengthen human and institutional capacities in energy planning, analysis, decision-making and policymaking

- Support the operationalization of power pool arrangements in each subregion, and the implementation of their master plans of action for the development of cross-border electricity, oil and gas exchange networks
- Design and implement energy access scale-up initiatives, particularly in rural areas, including new and innovative energy supply schemes and mechanisms that promote the development of productive and income generation activities, entrepreneurship, the utilization of indigenous energy resources, increased efficient energy consumption, and easier access to finance
- Enhance national capabilities of forestry services and energy agencies for wood energy planning and development, and design urgent measures to increase the provision of clean and affordable energy resources such as liquefied petroleum gas (LPG), for cooking and heating in households.

Air pollution and atmosphere

A. Feasible, workable and acceptable policy options identified

- Promote and adopt an integrated and regional approach in addressing air pollution and atmospheric issues
- Significantly scale up best practices and tested air pollution reduction and mitigation options in all sectors

B. Actions and practical measures recommended and undertaken

- Establishment of global atmosphere watch station for sub-Saharan Africa which provides measurements for long-term accounting of greenhouse gases and aerosols and the complex atmospheric chemical reactions which determine the depletion, transformation, lifetimes and transport of these gases and particles that contribute to climate change
- Implementation of the International Geosphere Biosphere Programme, which supported many regional and global scale studies focusing on emissions from Africa, through its International Global Atmospheric Chemistry core project

Climate change

A. Feasible, workable and acceptable policy options identified

- Enhance and promote policy coherence and integration of climate change mitigation and adaptation concerns into priority development policies and programmes including poverty reduction strategy papers
- Increase African countries' access to the funds and benefit from the Kyoto Mechanisms and Marrakech Funds by improving technical and institutional competence, establishment and operationalization of Designated National

Authorities and reducing the high transaction costs and streamlining the approval processes

- Support and accelerate the development and implementation of National Adaptation Programmes of Action

B. Actions and practical measures recommended and undertaken

- Implementation of projects to carry out assessment of the impact and adaptation to climate change and support to African countries to prepare National Adaptation Programmes of Action
- Establishment of climate forums such as the Southern African Regional Climate Outlook Forum for the Southern African Development Community subregion to enhance subregional cooperation on climate and for early warning and improved information sharing to reduce farmer and other vulnerabilities within the subregion

Industrial development

A. Feasible, workable and acceptable policy options identified

- Identify and facilitate access to financing options for the industrial sector to enable them to acquire state of the art sustainable production and efficient use technologies
- Promote global cooperation and partnerships for the development and implementation of cleaner production processes and adoption of new and safer technologies

B. Actions and practical measures recommended and undertaken

- Facilitating access to finance and technology transfer, capacity-building for growth-oriented and competitive micro and small-scale enterprises development, and increased empowerment of women, resulting in the establishment of agro-processing and micro and small-scale enterprises to foster rural development
- Establishment of National Cleaner Production Centres
- Development of policies for investment promotion and foreign direct investment, including the launching of UNIDO-Africa Investment Promotion Agency Network and various other national and subregional investment promotion efforts.

Annex II

Contribution from the Economic Commission for Europe region*

Energy for sustainable development

A. Policy options that have been identified in the ECE region

- ECE region offers huge potential for energy efficiency and energy savings. However, barriers need to be overcome for energy efficient measures to deliver their full potential; requiring education and awareness-raising, fostering behavioural change, regulatory and energy pricing reforms, emissions trading, and the establishment of adequate financing instruments
- Security of supply is of particular concern to the ECE region, and needs to be reinforced by diversifying both geographical and fuel sources, securing adequate investment in production, transport and distribution infrastructure, and deepening political dialogue between producer and consumer countries
- Diversification of energy supplies needs to include increasing the share of renewable energy, in line with the ECE regional commitment ahead of the World Summit on Sustainable Development, decreasing the environmental impact and carbon intensity of fossil energies and improving the energy efficiency of energy transformation and networks
- ECE region has a leading role to play in increasing research, development and demonstration of energy technologies, reducing unit costs and making these technologies available to countries with emerging and developing economies

B. Possible actions and practical measures that have been undertaken with success in the ECE region and/or those which have been recommended and are under active implementation by Governments

- ECE Project on Financing Energy Efficiency Investments for Climate Change Mitigation will provide for the establishment of a public-private partnership dedicated fund to finance energy efficiency investments in ECE countries with economies in transition. The project will promote the formation of an energy efficiency market in Eastern Europe, Caucasus and Central Asia so that cost-effective investments can provide a self-financing method of reducing Greenhouse Gases
- Facilitation of development of coal mine methane projects, which offer economic, social and environmental benefits to the local communities. An ECE project is under way to overcome the technical, economic and institutional barriers to development of such projects in Central and Eastern Europe and Eastern Europe, Caucasus and Central Asia and will result in a road map for financing coal mine methane projects and a tool kit to assist potential project sponsors

* Submitted by the Economic Commission for Europe.

- ECE has issued a set of guidelines for policymakers on reforming energy prices and subsidies (ECE/ENERGY/54), which were endorsed by Environment Ministers in Kiev in May 2003. Follow-up is now being undertaken to assess the impact and extent of the implementation of these guidelines across the ECE region.

Other issues of the Commission on Sustainable Development at its fifteenth session

- The ECE Strategy for Education for Sustainable Development adopted in 2005 provides a practical instrument to incorporate key themes of sustainable development in all education systems. Countries agreed to develop indicators to assess its implementation, organize thematic and subregional workshops and compile good practices in education for sustainable development
- The ECE Convention on the Transboundary Effects of Industrial Accidents aims at improving industrial safety and harmonizing safety standards across the ECE region. An internationally supported assistance programme is being implemented to address the challenges faced in the implementation of the Convention in Eastern Europe, Caucasus and Central Asia and South-East Europe countries
- Implementation of the ECE Convention on Long-range Transboundary Air Pollution and its protocols is key to effective air pollution control across the region. The Convention secretariat is making outreach efforts to share the experience of the Convention with other regions to reduce air pollution and address the increasingly prominent problems caused by intercontinental transport of air pollution. The increasing involvement of non-ECE states in the activities of the Convention sets a good stage for interregional cooperation on air pollution problems
- The Transport, Health and Environment Pan-European Programme addresses key challenges for the region to achieve more sustainable transport patterns and a closer integration of environmental and health concerns into transport policies.

Annex III

Contribution from the Latin America and the Caribbean region*

A. Policy options that have been identified in the Latin American and Caribbean region that are feasible, workable and acceptable to the region

Energy

- Several countries have implemented incentive mechanisms to accelerate market penetration of renewable energy sources and the development of biofuels, such as direct subsidies, active promotion of these alternative energy sources and regulation requiring a certain percentage share of renewable energy sources in national energy matrices to be achieved by some target date
- Implementation of energy efficiency policies throughout industrial, transport and household sectors to revert current trends of stagnant energy intensity. These include the development of energy efficiency standards (i.e., buildings, equipment), regulation and pricing policies to enhance energy efficiency, productivity and competitiveness across productive sectors, particularly in energy and natural resource intensive sectors facing continued high growth in the years ahead

Industrial development

Countries continue efforts to improve the management of environmental impacts of industrial activities and to promote investments in efficient and clean technologies, such as:

- **Cleaner production policies**. The majority of Latin American and Caribbean countries have put in place programmes and instruments designed to accelerate the absorption of cleaner and more efficient technologies in the industrial sector, and raising competitiveness through savings in energy use and raw material throughput
- **Recycling and reuse policies**. A large number of countries are promoting recycling and reuse through market creation for reusable waste products, and improved landfill and waste management, including improved economic opportunities for deprived social groups traditionally engaged in recycling and reuse activities
- **Promotion of markets emphasizing sustainable development criteria**. Several countries are actively promoting the creation of new markets through labelling and certification schemes for environmental goods and services, organic agriculture, and other products whose production incorporates social and environmentally responsible criteria

* Submitted by the Economic Commission for Latin America and the Caribbean.

Air/atmospheric pollution

The experiences of countries like Brazil, Chile and Mexico in managing air pollution have aroused interest among other countries, including actions such as:

- **Pollution control plans**: Involving integrated strategies and instruments based on health safety, mobilizing various levels of the public sector, as well as private firms, citizens and concerned groups
- **Sustainable cities programmes**: Many cities report successful applications of policies to promote bus rapid transit systems and some non-motorized mobility, urban planning and green areas

Climate change

Natural disasters as a consequence of climate change are a threat, and discussion of adaptation options and policies have been initiated, particularly in the Caribbean. These include natural disaster risk management actions, development of infrastructure, risk management procedure manuals, and many others. A majority of countries have implemented national offices and programmes to promote participation in the Kyoto Protocol Clean Development Mechanism. Projects in Latin America and the Caribbean have experienced significant growth since November 2005.

B. Possible actions and practical measures undertaken with success in the Latin American and Caribbean region and/or recommended and under active implementation by Governments

The following are examples of actions and practical measures implemented by countries which could be identified as concrete initiatives in all the above-mentioned topics.

Energy: Development of biofuels in Brazil and Central America. Energy integration schemes (Andean countries, Mercosur, Caribbean)

Industrial development: Clean production policies in Argentina, Chile and Colombia. Cross-cutting environmental/industrial initiatives in Mexico. Some Pollutant Release and Transfer Registers developed

Air/atmospheric pollution: Improvements in pollution abatement plans in Mexico and Sao Paulo

Climate change: Natural disaster investments in infrastructure in the Caribbean. Clean Development Mechanism initiatives in most countries, and some Greenhouse Gases inventories completed.

Annex IV

Contribution from the Asia and the Pacific region*

A. Policy options that have been identified in the Asia and the Pacific region

The following policy options under each thematic issue are of priority for the Asia and the Pacific region: (i) to accelerate the diversification of energy resources, with a focus on renewable energy and use of advanced environmentally sound technologies to widen access to energy services, support energy infrastructure development and improve energy efficiency; (ii) to foster sustainable industrial development, particularly SMEs, through promotion of markets for goods and services, expansion of environmentally sound technologies, production and marketing competitiveness and standardization of regulatory requirements; (iii) to promote the internalization of environmental costs in infrastructure investment decisions, change unsustainable production and consumption patterns and curb deteriorating air pollution, including indoor air pollution; and (iv) to address the climate change issue through mitigation and adaptation measures for agriculture, energy, forestry, human settlements, industry and marine ecosystems, more efficient use of fossil fuels and penetration of renewable energy in the energy mix, strengthening energy efficiency measures and regulations for energy use. In supporting such policy options the diversity of the Asia and the Pacific region calls for attention to the unique features of least developed countries, landlocked developing countries and small island developing States. In order to support the implementation of the policy options, necessary means of implementation would include: transfer of technology to developing countries, financial schemes to upgrade infrastructures and systems, enhanced cross-border regional and subregional collaboration, and integration of major groups to planning and decision-making.

B. Possible actions and practical measures that have been successful

With the successful outcome of the Fifth Ministerial Conference on Environment and the Pacific, held in Seoul in March 2005, "Green Growth", or environmentally sustainable economic growth, was unanimously endorsed as a new approach to move towards sustainable development. With the emergence of the new paradigm to address environmental problems through eco-efficiency of economic consumption, the "Green Growth" concept has provided the platform for policy dialogues on issues such as green tax and budget reform, sustainable consumption, and sustainable infrastructure development. The Asia-Pacific Regional Implementation Meeting was organized to discuss challenges and constraints to sustainable development and to seek lessons and success cases for determining policy options. Aiming to promote energy cooperation, the intergovernmental collaborative mechanism on energy cooperation in North-East Asia was established. Urban environmental policies and good practices, including measures to mitigate air pollution from point sources, were promoted through networks, information exchange, feasibility studies and pilot projects. National training workshops on the

* Submitted by the Economic and Social Commission for Asia and the Pacific.

development of national strategies for integrating rural development and energy policies and plans were conducted in seven countries. Capacity-building in strategic planning and management of natural resources in Asia and the Pacific was implemented to raise the effectiveness of policies and the energy and water resources sectors. A public-private community partnership pilot model to the provision of energy services at the community level was successfully implemented for replication. Through the Kitakyushu Initiative Network of local governments, promising policies and programmes are replicated to promote integrated and participatory approaches for the improvement of urban environmental quality, rationalization of energy and water use, and resource conscious solid waste management.

Annex V

Contribution from the West Asia region*

A. Policy options that have been identified in the Arab region

Energy for sustainable development

- The Arab energy sector has played and will continue to play an important role globally as well as within the region. It is serving as the source of oil and gas export revenues and satisfying energy needs for economic and social development. However, several challenges are facing the sector in achieving the objectives of energy for sustainable development in the region, including the rapidly increasing energy demand, lack of reliable energy supplies in rural and urban poor areas, the need to improve energy production and consumption efficiencies, limited support for renewable energy development and lack of appropriate mechanisms to support transfer of advanced energy technologies to the region
- During the last two decades, Arab countries have devoted efforts towards improving the sustainability of their energy sector, where reasonable but not sufficient progress has been achieved. The following measures and policies were identified and are gradually being adopted and promoted:

1. Enhancing access to affordable modern energy services for all communities mainly in rural and remote areas using a mix of available energy resources;
2. Upgrading energy production and consumption efficiencies, particularly in energy-intensive industries, transport and power sectors;
3. Promoting energy labelling, reviewing energy tariffs, and encouraging private ESCOs;
4. Enhancing investments in oil and gas exploration and production activities, using cleaner technologies, and adopting measures for reducing the sector's environmental impacts;
5. Promoting the use of natural gas in the power and transport sectors;
6. Developing renewable energy technologies and promote their application as appropriate to each of the country needs and resources;
7. Reviewing existing tariffs so as to support the economic management of the sector while maintaining energy subsidies for the poor;
8. Encouraging private sector participation in the establishment and management of energy facilities, including power plants and distribution networks;
9. Mobilizing funds for capacity-building, technology transfer and energy systems so as to meet increased energy demand.

* Submitted by the Economic and Social Commission for Western Asia.

Air pollution and climate change

Countries of the Arab region have exerted efforts towards assessing the sources and status of air pollution, particularly in mega cities. Ground-based monitoring networks as well as capabilities of satellite monitoring systems have been considered and the need for capacity-building on new air pollution monitoring and control techniques as well as adopting measures for mitigating climate change have also been addressed. The international community needs to support efforts to promote and implement the following policy options identified by countries in the region: (i) upgrading institutional capacities in the field of climate change; (ii) promoting technology transfer of environmentally sound technologies to the region; (iii) mitigating the impact of policies and measures adopted by the industrial countries to comply with the climate change convention.

Industrial development

Arab industry is recognizing the need to avoid or minimize waste generation through the introduction of new cleaner production technologies. Industrial environmental management is increasingly regarded in the region as an effective tool with which to improve production processes and materials and achieve efficient waste reduction, particularly in large-scale industries. Few of them have introduced the concept of the life-cycle assessment. Meanwhile, revision of environmental legislation has received increasing attention in recent years and institutional measures are being adopted to enhance industrial development. Arab countries would require greater technology transfer in the region to abate industrial pollution; this entails the encouragement of private sector development and the establishment of a national clearinghouse for waste exchange.

B. Possible actions and practical measures successful in the region and/or recommended and under active implementation by Governments

- Several Arab countries have adopted successful programmes for improving energy production and consumption efficiencies, mainly in the electric power, industrial and residential sectors. Programmes to improve energy efficiency have led to an increase in capacities of large groups, including high-level administration, engineers, technicians and the establishment of energy service companies. ESCWA is currently implementing a project for energy efficiency in the Qatari electric sector

- The Arab regional integration projects on electricity grid interconnection, gas networking have made considerable progress in recent years. A number of projects at the subregional level are at different stages of implementation and operation

- Partnership on energy for sustainable development, established through the Council of Arab Ministers Responsible for the Environment in close cooperation with ESCWA and UNEP/Regional Office for Western Africa. Several principal Arab declarations have been issued with a view to expressing

the concerns and commitments of the Arab countries in respect of the achievement of sustainable development

- The ESCWA regional promotional mechanism on energy systems for sustainable development, is a regional network of concerned authorities that proved to be effective in fostering regional cooperation, advocating for the development as well as field applications of such systems, and in building capacities of national professionals
- Several Arab countries (Egypt, Tunisia, Morocco, United Arab Emirates, and others) have implemented national programmes to promote participation in the Clean Development Mechanism. It is also worth mentioning that Saudi Arabia is taking serious steps in that direction
- Arab countries have achieved remarkable success in introducing cleaner and advanced fossil fuel technologies, such as switching to natural gas, upgrading the technologies of oil refineries, improving fuel specifications and adopting vehicles inspection and maintenance programmes.